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A CIVIL SERVICE MANUAL

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A CIVIL SERVICE MANUAL

BY

[illegible]

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VOLUME I
Arithmetic

THIRD EDITION
THE HOME CORRESPONDENCE SCHOOL
SPRINGFIELD, MASSACHUSETTS
1912

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By THE HOME CORRESPONDENCE SCHOOL
Springfield, Mass.

PREFACE

With the rapidly increasing popularity of Civil Service as an institution, the number of applicants for examination has passed high into the thousands. Whatever ability and training the applicant may have, to secure a rating that shall obtain an appointment, a thorough familiarity with, and preparation for the examination is necessary.

Much time and energy is misspent by the one who seeks to refresh his memory by cramming through the ordinary text-book, and even then the discipline most needed has not been acquired. This has been so thoroughly appreciated by individuals endeavoring to prepare themselves, and by large classes in public and private evening schools, correspondence schools, and associations, whose dependence was entirely upon their instructor's familiarity with the examinations, that there is a strong demand for a series of books which shall familiarize the applicant with the form and method of the examination, avoid the use of technical terms, and direct him in the study of only such matter as is necessary for his use.

The series, of which this book is one, consists of three books, the first dealing with arithmetic, the second with English and allied subjects, the third with geography, railway mail, and spelling. These books are, as the name implies, published for the express purpose of meeting the demands of Civil Service examinations, whether federal, state, or city, and, in the subjects treated, will be found to contain all material necessary to achieve the same success as has attended the many hundred members of our civil service classes in evening schools, for whose use this material was originally prepared.

These books are adapted to self-instruction, as well as to individual, class, and correspondence study under the guidance of a teacher.

As this book will be used by those who have previously studied arithmetic, the methods taught are not necessarily those

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Preface—*Continued*

that would be used for a first presentation of the subject, but rather those that experience has shown to be most helpful maturer students reviewing the subject for the special purpose taking these examinations.

THE AUTHORS.

GENERAL DIRECTIONS

In preparing for Civil Service examinations, whether federal, state, or city, the candidate should first communicate with the Commission by whom he is to be examined, and secure his application forms, together with all pamphlets of information which the Commission issues.*

As soon as his application is filed, the applicant should find out the exact requirements of his particular grade, and then make specific preparation for those requirements and no others. No one grade of examination requires all of the subjects treated in this manual.

Candidates are allowed to take the same examination repeatedly, but not oftener than once a year. By availing himself of this fact, a candidate may take an examination, after having once passed in the same grade, for the purpose of improving his rating; or he may take his examination before he is fully prepared, in order to become acquainted with its forms and methods, with the intention of repeating the examination for a higher rating at some future time.

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* These pamphlets, which are sent upon request, give details of information which are modified from time to time, and which are therefore not printed here. They also give specimen examination papers in the various grades, and the requirements as to height, weight, age, etc.

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ARITHMETIC

MEASUREMENTS—TABLES

Linear or Length Measures

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
5½ yards = 1 rod (rd.)
16½ feet = 1 rod
320 rods = 1 mile (mi.)
1,760 yards = 1 mile
5,280 feet = 1 mile

1 fathom (used in measuring the depth of the sea) = 6 feet
1 knot (used in navigation) = 1.15+ miles
1 league (used in navigation) = 3 knots
1 hand (used in measuring the heights of horses) = 4 inches
1 chain (used by land surveyors) = 66 feet
1 pace (used in measuring approximately) = 1/5 of a rod
1 barleycorn (used in grading the length of shoes) = 1/3 of an inch
1 furlong (a term nearly obsolete) = 1/8 of a mile

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards = 1 square rod (sq. rd.)
272¼ square feet = 1 square rod
160 square rods = 1 acre (A.)
4,840 square yards = 1 acre
43,560 square feet = 1 acre
640 acres = 1 square mile (sq. mi.)

Cubic Measure

1,728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

Wood Measure

128 cubic feet = 1 cord
16 cubic feet = 1 cord foot (cd. ft.)

Board Measure

The equivalent of a piece of lumber one foot square and one inch thick = 1 board foot. (All thicknesses less than one inch are ordinarily reckoned as one inch.)

Liquid Measure

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
31½ gallons = 1 barrel (bbl.)
63 gallons = 1 hogshead (hhd.)

A gallon equals 231 cubic inches.

Dry Measure

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

A bushel equals 2150.4 cubic inches.

United States Money

10 mills = 1 cent (¢)
10 cents = 1 dime
10 dimes = 1 dollar ($)
10 dollars = 1 eagle
20 dollars = 1 double eagle

Avoirdupois Weight

Avoirdupois weight is used in weighing articles of common use, such as coal, hay, grain, flour, and produce.

16 ounces (oz.) = 1 pound (lb.)
7,000 grains (gr.) = 1 pound
100 pounds = 1 hundredweight (cwt.)
20 hundredweight or 2,000 pounds = 1 ton (T.)
2,240 pounds = 1 long ton

Miscellaneous Weights

1 cubic foot of water = 62½ lb.
1 bushel of wheat = 60 lb.
1 bushel of beans = 60 lb.
1 bushel of clover seed = 60 lb.
1 bushel of potatoes = 60 lb.
1 bushel of shelled corn = 56 lb.
1 bushel of rye = 56 lb.
1 bushel of barley = 48 lb.
1 bushel of oats = 32 lb.
1 barrel of flour = 196 lb.
1 barrel of beef or pork = 200 lb.

Troy Weight

Troy weight is used in weighing gold, silver, and precious stones.

24 grains (gr.) = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce (oz.)
12 ounces = 1 pound (℔)
5,760 grains = 1 pound (℔)

Apothecaries' Weight

20 grains (gr.) = 1 scruple (℈)
3 scruples = 1 dram (ʒ)
8 drams = 1 ounce (℥)
12 ounces = 1 pound (℔)
5,760 grains = 1 pound (℔)

The pound Troy and the pound Apothecary weigh 5,760 grains each.

The pound Avoirdupois weighs 7,000 grains.

The ounce Troy and the ounce Apothecary weigh 480 grains each.

The ounce Avoirdupois weighs 437½ grains.

Miscellaneous Tables

12 units = 1 dozen
12 dozen = 1 gross
12 gross = 1 great gross
20 units = 1 score
24 sheets (paper) = 1 quire
20 quires = 1 ream

Apothecaries' Fluid Measure

60 minims = 1 fluid dram (ƒʒ)
8 fluid drams = 1 fluid ounce (ƒ℥)
16 fluid ounces = 1 pint (0)
8 pints = 1 gallon (Cong.)

One minim of water is about one drop.

Angular Measure

60 seconds (′′) = 1 minute (′)
60 minutes = 1 degree (°)
90 degrees = 1 quadrant (q'd't)
360 degrees = 1 circumference

The length of one degree of longitude at the equator = miles.

Measure of Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
365 days = 1 common year
52 weeks, 1 day = 1 common year
366 days = 1 leap year
52 weeks, 2 days = 1 leap year

Wall Paper Measure

Wall paper comes in rolls and double rolls, eighteen inches v

8 yards or 24 feet = 1 single roll
16 yards or 48 feet = 1 double roll

Fractional Parts of 100

$\frac{1}{2} = \frac{50}{100}$ or $.50$ or 50%

$\frac{1}{3} = \frac{33\frac{1}{3}}{100}$ or $.33\frac{1}{3}$ or $33\frac{1}{3}\%$

$\frac{1}{4} = \frac{25}{100}$ or $.25$ or 25%

$\frac{1}{5} = \frac{20}{100}$ or $.20$ or 20%

$\frac{1}{6} = \frac{16\frac{2}{3}}{100}$ or $.16\frac{2}{3}$ or $16\frac{2}{3}\%$

$\frac{1}{7} = \frac{14\frac{2}{7}}{100}$ or $.14\frac{2}{7}$ or $14\frac{2}{7}\%$

$\frac{1}{8} = \frac{12\frac{1}{2}}{100}$ or $.12\frac{1}{2}$ or $12\frac{1}{2}\%$

$\frac{1}{9} = \frac{11\frac{1}{9}}{100}$ or $.11\frac{1}{9}$ or $11\frac{1}{9}\%$

$\frac{1}{10} = \frac{10}{100}$ or $.10$ or 10%

$\frac{1}{12} = \frac{8\frac{1}{3}}{100}$ or $.08\frac{1}{3}$ or $8\frac{1}{3}\%$

$\frac{1}{16} = \frac{6\frac{1}{4}}{100}$ or $.06\frac{1}{4}$ or $6\frac{1}{4}\%$

$\frac{1}{20} = \frac{5}{100}$ or $.05$ or 5%

$\frac{1}{25} = \frac{4}{100}$ or $.04$ or 4%

$\frac{1}{33\frac{1}{3}} = \frac{3}{100}$ or $.03$ or 3%

$\frac{1}{50} = \frac{2}{100}$ or $.02$ or 2%

The foregoing table shows also the fractional parts of a dollar in the third column. For example: $\$\frac{1}{2} = \$0.50$ or 50¢; $\$\frac{1}{3} = \$0.33\frac{1}{3}$ or $33\frac{1}{3}$¢.

Exercises

After studying carefully the table given above, cover with a piece of paper all but the first column and write the per cent opposite each fraction. Then remove the paper and compare what you have written with the table.

Repeat this exercise, writing the number of hundredths ($\frac{4}{100}$, $\frac{14\frac{2}{7}}{100}$, etc.,) instead of the per cent.

Next write the fractional parts of a dollar in the same way.

Note: These exercises are extremely valuable and should not be abandoned until the table has been thoroughly mastered.

NUMBER READING

Arabic Numerals

Trillions.	Hundred-billions.	Ten-billions.	Billions.	Hundred-millions.	Ten-millions.	Millions.	Hundred-thousands.	Ten-thousands.	Thousands.	Hundreds.	Tens.	Units.	Decimal point.	Tenths.	Hundreths.	Thousandths.	Ten-thousandths.	Hundred-thousandths	Millionths.	Ten-millionths.	Hundred-millionths	Billionths.	Ten-billionths.	Hundred-billionths.	Trillionths.
9,	1	6	5,	2	8	9,	7	1	3,	4	6	8	.	8	6	4	3	1	7	9	8	2	5	6	1

a	18.1
b	217.39
c	5,336.285
d	39,425.5774
e	498,744.45639
f	5,622,653.668749
g	47,278,572.7438956
h	796,817,481.92267345
i	3,233,956,169.839524761
j	82,765,345,679.8216543176
k	312,465,891,257.28346897289
l	9,431,768,392,765.843917684547

Note: "And" should be used *only* at the place of the decimal point.

m	7.4
n	37.06
o	435.008
p	7,006.0004
q	60,805.50206
r	800,920.060009
s	7,000,645.9702038
t	28,020,084.30000609
u	400,309,000.903000003
v	4,000,026,400.7004007005
w	70,907,850,030.03870220743
x	109,030,000,001.000050006076

(aa to xx are correct readings of a to x.)

aa Eighteen and one tenth.

bb Two hundred seventeen and thirty-nine hundredths.

cc Five thousand three hundred thirty-six and two hundred eighty-five thousandths.

dd Thirty-nine thousand four hundred twenty-five and five thousand seven hundred seventy-four ten-thousandths.

ee Four hundred ninety-eight thousand seven hundred forty-four and forty-five thousand six hundred thirty-nine hundred-thousandths.

ff Five million six hundred twenty-two thousand six hundred fifty-three and six hundred sixty-eight thousand seven hundred forty-nine millionths.

gg Forty-seven million two hundred seventy-eight thousand five hundred seventy-two and seven million four hundred thirty-eight thousand nine hundred fifty-six ten-millionths.

hh Seven hundred ninety-six million eight hundred seventeen thousand four hundred eighty-one and ninety-two million two hundred sixty-seven thousand three hundred forty-five hundred-millionths.

ii Three billion two hundred thirty-three million nine hundred fifty-six thousand one hundred sixty-nine and eight hundred thirty-nine million five hundred twenty-four thousand seven hundred sixty-one billionths.

jj Eighty-two billion seven hundred sixty-five million three hundred forty-five thousand six hundred seventy-nine and eight billion two hundred sixteen million five hundred forty-three thousand one hundred seventy-six ten-billionths.

kk Three hundred twelve billion four hundred sixty-five million eight hundred ninety-one thousand two hundred fifty-seven and twenty-eight billion three hundred forty-six million eight hundred ninety-seven thousand two hundred eighty-nine hundred-billionths.

ll Nine trillion four hundred thirty-one billion seven hundred sixty-eight million three hundred ninety-two thousand seven hundred sixty-five and eight hundred forty-three billion nine hundred seventeen million six hundred eighty-four thousand five hundred forty-seven trillionths.

mm Seven and four tenths.

nn Thirty-seven and six hundredths.

oo Four hundred thirty-five and eight thousandths.

pp Seven thousand six and four ten-thousandths.

qq Sixty thousand eight hundred five and fifty thousand two hundred six hundred-thousandths.

rr Eight hundred thousand nine hundred twenty and sixty thousand nine millionths.

ss Seven million six hundred forty-five and nine million seven hundred two thousand thirty-eight ten-millionths.

tt Twenty-eight million twenty thousand eighty-four and thirty million six hundred nine hundred-millionths.

uu Four hundred million three hundred nine thousand and nine hundred three million three billionths.

vv Four billion twenty-six thousand four hundred and seven billion four million seven thousand five ten-billionths.

ww Seventy billion nine hundred seven million eight hundred fifty thousand thirty and three billion eight hundred seventy million two hundred twenty thousand seven hundred forty-three hundred-billionths.

xx One hundred nine billion thirty million one and fifty million six thousand seventy-six trillionths.

(**a** to **x** are correct writings of **aa** to **xx**.)

Exercise I. Read the integral parts of the given numbers from **a** to **x** regardless of decimals.

Exercise II. Write the integral parts of the given numbers from **aa** to **xx** regardless of decimals.

Exercise III. Read the decimal parts of the given numbers from **a** to **x** regardless of integers.

Exercise IV. Write the decimal parts of the given numbers from **aa** to **xx** regardless of integers.

Important Note—The word "and" should not be used in reading whole numbers or simple decimals.

Exercise V. Read the given numbers from **a** to **x** as they were read in Exercises **I** and **III** using "and" to connect the integers and decimals. (The word "and" indicates separation between an integer and a fraction, whether common or decimal.)

Exercise VI. Write the given numbers from **aa** to **xx** as they were written in Exercises **II** and **IV.**

Exercise VII. Read the following:

1	(a)	200.002	(b)	.202
2	(a)	500.017	(b)	.517
3	(a)	2000.0345	(b)	.2345
4	(a)	12000.00816	(b)	.12816
5	(a)	16200.00075	(b)	.16275

Note—The word "and" is used in reading those numbers in the above exercises that are lettered (a).

The word "and" is not used in reading those numbers in the above exercises that are lettered (b).

ROMAN NUMERALS

One = I
Two = II (See Illustration I, below
Three = III (See Ills. I)
Four = IV (See Ills. III)
Five = V
Six = VI (See Ills. II)
Seven = VII (See Ills. II and I)
Eight = VIII (See Ills. II and I)
Nine = IX (See Ills. III)
Ten = X
Forty = XL (See Ills. III)
Fifty = L
Ninety = XC (See Ills. III)
One Hundred = C
Four Hundred = CD (See Ills. III)
Five Hundred = D
Nine Hundred = CM (See Ills III)
One Thousand = M
Five Thousand = $\overline{V}$ (See Ills. IV)
Five Hundred Thousand = $\overline{D}$ (See Ills IV)
One Million = $\overline{M}$ (See Ills IV)

Illustration I. Given the expression XXX. The numeral being repeated, the numerical value of the expression is the sum of all the numerals; or 10+10+10=30; therefore, XXX=30. II is 1+1 or 2; III is 1+1+1 or 3; XX is 10+10 or 20; CC is 100+100 or 200; CCC is 100+100+100 or 300; MM is 1000+1000 or 2000.

NOTE—The numerals V, L and D are not repeated.

The numerals are not written more than three times successively. For example: 9 is written IX and not VIIII; 40 is written XL and not XXXX; 400 is written CD and not CCCC. Exception: 4 is written either IV or IIII with the former preferred.

Illustration II. Given the expression XVI The smaller numerals V and I being placed after the larger numeral X, (and neither of the smaller numerals being followed by one larger than itself) the numerical value of the expression is the sum of all the numerals; or 10+5+1=16; therefore XVI=16. XV is 10+5 or 15; LV is 50+5 or 55; LXVI is 50+10+5+1 or 66; CLXV is 100+50+10+5 or 165; DCXVI is 500+100+10+5+1 or 616; MDLXI is 1000+500+50+10+1 or 1561.

Illustration III. Given the expression IX. The **smaller** numeral I being placed **before** the **larger** numeral X signifies that the numerical value of the expression is the difference between the two numerals; or 1 from 10 leaves 9; therefore IX = 9. XL is 10 from 50 or 40; XC is 10 from 100 or 90; CD is 100 from 500 or 400; CM is 100 from 1000 or 900.

Note—V, L and D are not used to precede larger numerals.

Illustration IV. Given the expression $\overline{\text{M}}$. The horizontal line placed over the numeral indicates that its value is multiplied by one thousand; therefore the numerical value of $\overline{\text{M}}$ is 1,000,000. The other numerals except I may be used in like manner.

Illustration V. The foregoing illustrations are used in combination. $\overline{\text{M}}$DCCCLXXIV is 1,000,000+500+100+100+100+50+10+10+4(one from five) or 1,000,874; MCCXLIX is 1000+100+100+40 (tcn from fifty) +9 (one from ten) or 1,249; $\overline{\text{M}}\overline{\text{D}}$CI is 1,000,000+500,000+100+1 or 1,500,101.

Exercises

Write the following numbers, using the Roman system of notation:—

1 15
2 21
3 67
4 84
5 90
6 14
7 89
8 135
9 267
10 824
11 23
12 46
13 69
14 349
15 471
16 44
17 77
18 401
19 764
20 1285
21 49
22 524
23 960
24 1379
25 2494
26 99
27 1016
28 1812
29 2919
30 2449
31 104
32 1861
33 1285
34 1909
35 10126
36 449
37 1776
38 1619
39 10379
40 11111
41 996
42 1607
43 12345
44 11472
45 10993
46 567
47 1492
48 1904
49 2996
50 10343
51 873
52 462
53 1906
54 12444
55 10949
56 1932
57 3444
58 2999
59 11916
60 1505492

ADDITION—INTEGERS

8
7
6
4
3
5
33

In adding a column of figures, always repeat the process until the same sum is again obtained, first adding upward and then downward, i. e., 8+7+6+4+3+5=33 and 5+3+4+6+7+8=33. Obtaining the same sum, 33, each time convinces one that the addition is correct.

14
16
28
27
18
103

When there is an amount to be carried to the next column, begin with that amount and add to it. If it is left to be added at the last, it is likely to be forgotten, i. e., 3 is carried to the second column, then 3+1+2+2+1+1=10 and 3+1+1+2+2+1=10.

The foregoing suggestions should be practised until they are fixed habits.

There is no excuse for errors in addition, but the great majority of people will make them again and again. Much practice, long continued, is the best means of assuring accuracy.

Illustrative problem:

			Added horizontally Sums
2176	5462	4276	11914
3189	7853	8933	19975
6421	3476	4531	14428
7329	2117	9986	19432
2007	7893	4524	14424
21122	26801	32250	80173 Answer

The numbers are first added horizontally, which in this case, gives a fourth column of figures; then the numbers are added vertically, which in this problem, gives three sums. The sum of the fourth column is the same as the sum of the results obtained from the vertical additions. This final sum is the answer.

Exercises

Add.

1	1673	6756	6741
	1976	1432	9862
	5244	2597	3714
	9622	6933	8670
	7365	1726	4327
	4233	1835	9321
2	14361	19641	1041
	295	3	976
	6724	17	39
	59	14319	11417
	6138	245	307
	10007	1670	9821
3	12345	5	2345
	1234	65	12345
	123	765	345
	12	8765	45
	1	98765	5
	21	56789	5432
	321	5678	54321
	4321	567	4321
	54321	56	321
4	98765	56789	9999
	9876	9876	888
	987	456	7777
	98	32	666
	9	65	5555
	89	345	444
	6789	1234	33
	56789	54321	22222
5	309	18273	12534
	207	75267	1934
	2657	89842	2377
	7777	65758	8429
	23472	32855	99426
	5755	27659	17898

6	700	210286	189300
	19897	109600	28401
	6824	46	464874
	2095	8007	29107
	535	81610	13
	18916	407	406
7	4006	606707	682012
	80710	804010	69011
	47	981	50923
	176234	2184	79891
	61981	63741	1478
	4286	9	7018
8	4628	5432	9176
	312	8976	4235
	9467	8500	643
	7142	6542	9143
	6543	9278	6394
9	8463	9172	8430
	2168	4273	4391
	719	315	9614
	784	217	9168
	2111	4394	7188
	563	1984	219
10	2418	2972	85
	6843	9173	856
	298	987	8247
	4387	4623	9172
	5687	8007	1810
	48763	8992	11087

ADDITION—DECIMALS

In addition of decimals the figures should be written in even vertical columns, with **decimal points under each other.**

Avoid errors by forming the columns with much care.

The process is the same as in addition of integers.

The **decimal point** in the sum should be placed directly beneath the decimal points in the column added.

Illustrations:

.8	3.48	29.878	6.5
3.71	86.075	.82	847
.006	.4	3.753	29.63
7.75	36.869	20.857	8.457
12.266 Ans.	126.824 Ans.	55.308 Ans.	45.434 Ans.

Written Exercises

Add:

1	741.675	.8	.45
✓	1.007	76.943	9.678
	4165.0108	836.012	18.4321
	9.017	4.0175	1.2345
	414.08	316.1	26.00006
2	10.1	4.1875	15.08
	15.25	4.15625	133.625
	20.2625	4.1475	155.4587
	32.175	4.1625	271.806
	60.08375	7.2225	55.9
	17.14636	6.12375	1672.00007

3 .67365 + .4321 + .237 + .14 + .9 + 10 =

4 34.6705 + 100.01 + 4.07615 + 19.1 + 5.013 =

5 .001 + 1000. + 45.016 + 5.05705 + 7.19 =

6 A farm consisted of 14.625 acres of tilled ground, 28.35 acres of timber, and 21.51 acres of pasture land. How many acres were there in the entire farm?

7 In crossing the ocean, one day the steamer sailed 452.12 miles, the next day, 175.006 miles, the third, 314.65 miles, and the fourth, 516.75 miles. How far did it sail in the four days?

ADDITION—UNITED STATES MONEY

(See Table)

NOTATION OF UNITED STATES MONEY

$48.00 = forty-eight dollars.

$48.24 = forty-eight dollars and twenty-four cents.

$48.245 = forty-eight dollars, twenty-four cents and five mills.

$48.2457 = forty-eight dollars, twenty-four cents, five and seven-tenths mills.

This is an application of addition of decimals. In adding, dollars must be placed under dollars, cents under cents, mills under mills, etc. Use great care in writing accurately the numbers to be added.

$ 48.76	$ .046	$21463.07
7.24	.0892	1682.093
784.075	1.076	10000.
.69	3.00	76.85
$840.765 Ans.	$4.2112 Ans.	$33222.013 Ans.

Written Exercises

Add:

1	$ 216.75	$9876.35	$3761.1216
	423.103	6402.174	45.09
	96.04	8.23	394.134
	1876.625	117.1475	4125.7563
	5.1921	36.09	6.15
2	$9163.14	$ 17.24	$9265.04
	417.26	5005.82	591.72
	38.09	317.16	416.53
	95.18	405.07	95.95
	5416.25	1798.83	116.12

3 A merchant's sales for one week were: Monday, $517.24; Tuesday, $468.83; Wednesday, $385.92; Thursday, $419.11;

Friday, $465.34; Saturday, $624.43. What was the total amount of sales for the week?

4 The expenses of a family for the month of December were: rent, $18.50; fuel, $4.84; light, $2.63; groceries, $9.88; provisions, $11.38; incidentals, $16.42. Find the total of expenses for the month.

5 A's lot of land cost him $816.53; B's, $924.18; C's, $1238.; D's, $719.58; E's, $1468.92; F's, $1008.81. What was the entire cost of the six lots?

6 A street car conductor made six trips on a certain day, collecting the following amounts in fares; $3.85, $5.20, $8.95, $14.15, $10.00, and $7.60. How much did he turn in at the close of the day?

7 A clerk made the following sales during one day's business; $35.00, $2.46, $1.50, $8.34, $98.68, $3.50, $5.25, $1.24, $43.08 and $7.68. What was the amount of the sales?

8 In building a house, a man paid $1,864.00 for land, $740.00 for the foundation, $1,500.00 for labor, and $4,650.00 for materials. What was the total cost?

9 During the first half of the year 1908 my gas bills were: January, $2.56; February, $2.16; March, $2.16; April, $2.24; May, $2.00; June, $2.16. How much did I pay for gas in the six months?

10 In counting his money, a bank teller found that he had $12.69 in pennies, $68.05 in nickels, $40.50 in quarters, $17.00 in half dollars, and $1,487.00 in bills. How much money did he have?

REDUCTION—COMMON FRACTIONS

To higher or lower terms

Higher terms:

$\frac{1}{3}=\frac{3}{9}$ $\frac{2}{5}=\frac{4}{10}$ $\frac{2}{3}=\frac{8}{12}$ $\frac{3}{8}=\frac{6}{16}$

Observe:—Multiplying both terms of a fraction by the **same** number does not change the value of the fraction.

Illustrations continued:

I $\frac{3}{8}=\frac{18}{48}\left\{\begin{array}{l}3\text{ multiplied by}\\8\text{ multiplied by}\end{array}6\right\}$ III $\frac{5}{8}=\frac{60}{96}\left\{\begin{array}{l}5\text{ multiplied by}\\8\text{ multiplied by}\end{array}12\right\}$

II $\frac{7}{9}=\frac{49}{63}\left\{\begin{array}{l}7\text{ multiplied by}\\9\text{ multiplied by}\end{array}7\right\}$ IV $\frac{3}{4}=\frac{48}{64}\left\{\begin{array}{l}3\text{ multiplied by}\\4\text{ multiplied by}\end{array}16\right\}$

Change $\frac{3}{8}$ to 32nds.

$32\div 8=4$

Multiply 8 by 4 to obtain 32

$\frac{3}{8}=\frac{12}{32}\left\{\begin{array}{c}\text{multiplying both}\\\text{terms by 4}\end{array}\right\}$ Ans.

Mental Exercises

Change:

1 $\frac{1}{3}$ to 6ths
2 $\frac{1}{4}$ to 12ths
3 $\frac{1}{5}$ to 15ths
4 $\frac{1}{7}$ to 21sts
5 $\frac{2}{5}$ to 25ths
6 $\frac{3}{8}$ to 32nds
7 $\frac{7}{10}$ to 100ths
8 $\frac{5}{6}$ to 18ths
9 $\frac{4}{7}$ to 28ths
10 $\frac{7}{8}$ to 48ths
11 $\frac{6}{7}$ to 42nds
12 $\frac{5}{9}$ to 81sts
13 $\frac{2}{7}$ to 63rds
14 $\frac{5}{7}$ to 77ths
15 $\frac{2}{9}$ to 72nds
16 $\frac{3}{11}$ to 99ths
17 $\frac{8}{15}$ to 45ths
18 $\frac{11}{13}$ to 39ths
19 $\frac{7}{12}$ to 144ths
20 $\frac{9}{14}$ to 84ths
21 $\frac{13}{17}$ to 102nds
22 $\frac{14}{15}$ to 105ths
23 $\frac{7}{18}$ to 108ths
24 $\frac{9}{17}$ to 85ths
25 $\frac{5}{21}$ to 189ths
26 $\frac{17}{27}$ to 81sts
27 $\frac{20}{21}$ to 105ths
28 $\frac{13}{19}$ to 76ths
29 $\frac{22}{23}$ to 161sts
30 $\frac{26}{31}$ to 217ths

Lower terms

$\frac{3}{9}=\frac{1}{3}$ $\frac{4}{10}=\frac{2}{5}$ $\frac{8}{12}=\frac{2}{3}$ $\frac{6}{16}=\frac{3}{8}$

Observe:—Dividing both terms of a fraction by the **same** number does not change the value of the fraction.

$\frac{3}{9}=\frac{1}{3}\left\{\begin{array}{l}3\text{ divided by}\\9\text{ divided by}\end{array}3\right\}$ $\frac{4}{10}=\frac{2}{5}\left\{\begin{array}{r}4\text{ divided by}\\10\text{ divided by}\end{array}2\right\}$

Illustrations continued:

I $\frac{64}{72}=\frac{8}{9}\left\{\begin{array}{l}\text{64 divided by}\\ \text{72 divided by}\end{array}8\right\}$

II $\frac{27}{45}=\frac{3}{5}\left\{\begin{array}{l}\text{27 divided by}\\ \text{45 divided by}\end{array}9\right\}$

III $\frac{144}{600}=\frac{72}{300}\left\{\begin{array}{c}\text{dividing both}\\ \text{terms by 2}\end{array}\right\}=\frac{36}{150}\left\{\begin{array}{c}\text{dividing both}\\ \text{terms by 2}\end{array}\right\}=$ $\frac{18}{75}\left\{\begin{array}{c}\text{dividing both}\\ \text{terms by 3}\end{array}\right\}=\frac{6}{25}\left\{\begin{array}{c}\text{dividing both}\\ \text{terms by 3}\end{array}\right\}$, $\frac{6}{25}$ cannot be further reduced and is therefore said to be in its lowest terms.

All fractions in answers should be in lowest terms

Written Exercises

Reduce to lowest terms:

1 $\frac{8}{12}$
2 $\frac{7}{42}$
3 $\frac{21}{24}$
4 $\frac{35}{42}$
5 $\frac{39}{52}$
6 $\frac{56}{168}$
7 $\frac{15}{120}$
8 $\frac{33}{51}$
9 $\frac{36}{48}$
10 $\frac{73}{365}$
11 $\frac{15}{175}$
12 $\frac{42}{63}$
13 $\frac{121}{132}$
14 $\frac{98}{175}$
15 $\frac{50}{155}$
16 $\frac{63}{84}$
17 $\frac{86}{215}$
18 $\frac{39}{104}$
19 $\frac{170}{275}$
20 $\frac{360}{740}$
21 $\frac{92}{100}$
22 $\frac{54}{81}$
23 $\frac{76}{108}$
24 $\frac{31}{248}$
25 $\frac{81}{153}$
26 $\frac{96}{144}$
27 $\frac{120}{144}$
28 $\frac{75}{135}$
29 $\frac{108}{120}$
30 $\frac{84}{228}$

To find the number which will divide both terms of a fraction when that is not easily determined by inspection:

```
Given 513/627                                          1
                                                     ----
Divide the larger number by the smaller.          513)627
                                                      513    4
                                                      --------
Divide the preceding divisor by the remainder.        114)513
                                                          456    2
                                                          --------
Divide the preceding divisor by the remainder              57)114
                                                              114
                                                              ---
There is no remainder.                                          0
```

The last divisor used, 57, is the largest number that will exactly divide both terms of the given fraction.

$$\frac{513}{627}=\left\{\begin{array}{c}\text{dividing both}\\ \text{terms by 57}\end{array}\right\}\frac{9}{11}$$

Given $\frac{1953}{2325}$

```
           1
1953)2325
     1953      5
      372)1953
          1860    4
            93)372
               372
                 0
```

$$\frac{1953}{2325} = \left\{\begin{array}{c}\text{dividing both}\\ \text{terms by 93}\end{array}\right\} \frac{21}{25}$$

Written Exercises

Reduce to lowest terms:

1 $\frac{544}{969}$
2 $\frac{468}{576}$
3 $\frac{861}{984}$
4 $\frac{319}{407}$
5 $\frac{856}{936}$
6 $\frac{162}{864}$
7 $\frac{648}{810}$
8 $\frac{374}{361}$
9 $\frac{425}{272}$
10 $\frac{595}{665}$

11 $\frac{292}{657}$
12 $\frac{126}{162}$
13 $\frac{253}{276}$
14 $\frac{221}{187}$
15 $\frac{437}{513}$
16 $\frac{468}{663}$
17 $\frac{377}{551}$
18 $\frac{689}{1715}$
19 $\frac{297}{378}$
20 $\frac{639}{1737}$

21 $\frac{668}{697}$
22 $\frac{329}{703}$
23 $\frac{689}{1113}$
24 $\frac{273}{323}$
25 $\frac{1407}{1809}$
26 $\frac{1582}{2599}$
27 $\frac{1768}{2021}$
28 $\frac{1344}{1536}$
29 $\frac{5222}{7042}$
30 $\frac{5648}{5940}$

IMPROPER FRACTIONS

To change improper fractions to whole or mixed numbers

Change $\frac{440}{3}$ to a whole or mixed number. $\frac{3}{3}=1$. $\frac{440}{3}=$ as many ones as 3 thirds is contained times in 440 thirds or $146\frac{2}{3}$ times; therefore $146\frac{2}{3}$ ones, Ans.

Or, $\frac{440}{3}=440\div 3=146\frac{2}{3}$, Ans.

Change $\frac{215}{5}$ to a whole or mixed number. $\frac{5}{5}=1$. $\frac{215}{5}=$ as many ones as 5 fifths is contained times in 215 fifths, or 43 times; therefore, 43 ones, Ans.

Or, $\frac{215}{5}=215\div 5=43$, Ans.

Change, $\frac{35}{6}$, $\frac{117}{9}$, $\frac{143}{12}$ and $\frac{95}{70}$ to whole or mixed numbers.

$\frac{35}{6}=35\div 6=5\frac{5}{6}$, Ans.

$\frac{117}{9}=117\div 9=13$, Ans.

$\frac{143}{12}=143\div 12=11\frac{11}{12}$, Ans.

$\frac{95}{70}=95\div 70=1\frac{25}{70}=1\frac{5}{14}$, Ans.

Mental Exercises

Change the following improper fractions to whole or mixed numbers:

1 $\frac{88}{11}$
2 $\frac{244}{9}$
3 $\frac{1111}{10}$
4 $\frac{762}{7}$
5 $\frac{858}{12}$
6 $\frac{476}{7}$
7 $\frac{1245}{4}$
8 $\frac{1845}{6}$
9 $\frac{4407}{5}$
10 $\frac{8872}{8}$
11 $\frac{2184}{6}$
12 $\frac{656}{12}$
13 $\frac{6996}{6}$
14 $\frac{213}{12}$
15 $\frac{345}{9}$
16 $\frac{861}{10}$
17 $\frac{9672}{8}$
18 $\frac{1848}{4}$
19 $\frac{265}{9}$
20 $\frac{100}{11}$
21 $\frac{4128}{4}$
22 $\frac{1111}{11}$
23 $\frac{864}{9}$
24 $\frac{89}{6}$
25 $\frac{283}{7}$
26 $\frac{580}{5}$
27 $\frac{108}{11}$
28 $\frac{8742}{4}$
29 $\frac{500}{9}$
30 $\frac{6345}{6}$
31 $\frac{8826}{7}$
32 $\frac{710}{12}$
33 $\frac{808}{8}$
34 $\frac{6984}{11}$
35 $\frac{948}{6}$
36 $\frac{684}{8}$.
37 $\frac{359}{3}$
38 $\frac{1857}{11}$
39 $\frac{6672}{12}$
40 $\frac{2126}{12}$

Written Exercises

1 $\frac{887}{16}$
2 $\frac{244}{19}$
3 $\frac{2216}{19}$
4 $\frac{1126}{563}$
5 $\frac{866}{758}$
6 $\frac{121}{17}$
7 $\frac{6672}{81}$
8 $\frac{1949}{359}$
9 $\frac{165}{39}$.
10 $\frac{1111}{101}$
11 $\frac{1234}{56}$
12 $\frac{66800}{806}$
13 $\frac{865}{16}$
14 $\frac{1234}{23}$
15 $\frac{4896}{112}$
16 $\frac{4808}{58}$
17 $\frac{1073}{31}$
18 $\frac{6561}{111}$
19 $\frac{16996}{22}$
20 $\frac{21359}{47}$
21 $\frac{2631}{13}$
22 $\frac{4999}{18}$
23 $\frac{5234}{30}$
24 $\frac{9436}{36}$
25 $\frac{6211}{365}$
26 $\frac{2766}{18}$
27 $\frac{4321}{65}$
28 $\frac{6934}{211}$
29 $\frac{8084}{85}$
30 $\frac{3701}{13}$
31 $\frac{1656}{221}$
32 $\frac{69961}{33}$
33 $\frac{95312}{74}$
34 $\frac{1362}{31}$
35 $\frac{9874}{81}$
36 $\frac{6349}{78}$
37 $\frac{7310}{42}$
38 $\frac{6165}{321}$
39 $\frac{9669}{27}$
40 $\frac{3592}{56}$

To change mixed numbers to improper fractions

Change $4\frac{1}{2}$ to an improper fraction.

$1=\frac{2}{2}$. $4=4$ times $\frac{2}{2}=\frac{8}{2}$. $4\frac{1}{2}=\frac{8}{2}+\frac{1}{2}=\frac{9}{2}$, Ans.

Change $35\frac{2}{3}$ to an improper fraction.

$1=\frac{3}{3}$. $35=35$ times $\frac{3}{3}=\frac{105}{3}$. $35\frac{2}{3}=\frac{105}{3}+\frac{2}{3}=\frac{107}{3}$, Ans.

Change $14\frac{3}{5}$, $1\frac{19}{20}$, $7\frac{3}{8}$, and $3\frac{13}{15}$ to improper fractions.

Multiply the integer by	14	1	7	3
the number below the line	×5	×20	× 8	×15
	70	20	56	45
Add the number above the line	+ 3	+19	+ 3	+13
	73	39	59	58

Therefore, $14\frac{3}{5}=\frac{73}{5}$. $1\frac{19}{20}=\frac{39}{20}$. $7\frac{3}{8}=\frac{59}{8}$. $3\frac{13}{15}=\frac{58}{15}$.

Mental Exercises

Change the following mixed numbers to improper fractions:

1 $2\frac{3}{4}$
2 $3\frac{5}{6}$
3 $4\frac{3}{8}$
4 $5\frac{2}{5}$
5 $6\frac{1}{4}$
6 $8\frac{3}{4}$
7 $9\frac{5}{8}$
8 $14\frac{3}{4}$
9 $24\frac{1}{3}$
10 $14\frac{4}{5}$
11 $40\frac{3}{8}$
12 $17\frac{7}{10}$
13 $6\frac{4}{15}$
14 $3\frac{5}{12}$
15 $5\frac{9}{11}$
16 $4\frac{11}{13}$
17 $3\frac{7}{15}$
18 $4\frac{8}{13}$
19 $3\frac{1}{30}$
20 $7\frac{13}{50}$
21 $5\frac{37}{100}$
22 $37\frac{3}{4}$
23 $8\frac{19}{20}$
24 $15\frac{3}{5}$
25 $16\frac{2}{3}$
26 $37\frac{1}{2}$
27 $62\frac{1}{2}$
28 $11\frac{1}{9}$
29 $7\frac{7}{12}$
30 $15\frac{2}{3}$
31 $87\frac{1}{2}$
32 $9\frac{1}{11}$
33 $3\frac{11}{19}$
34 $15\frac{7}{10}$
35 $9\frac{8}{16}$
36 $173\frac{1}{100}$
37 $81\frac{1}{6}$
38 $4\frac{14}{15}$
39 $19\frac{1}{8}$
40 $21\frac{5}{9}$

Written Exercises

1 $74\frac{8}{13}$
2 $113\frac{5}{18}$
3 $206\frac{18}{25}$
4 $86\frac{5}{16}$
5 $349\frac{11}{20}$
6 $150\frac{7}{80}$
7 $153\frac{5}{14}$
8 $25\frac{51}{274}$
9 $81\frac{1}{61}$
10 $206\frac{5}{23}$
11 $125\frac{3}{13}$
12 $402\frac{1}{31}$
13 $543\frac{2}{11}$
14 $672\frac{3}{13}$
15 $611\frac{3}{52}$
16 $361\frac{21}{29}$
17 $306\frac{18}{53}$
18 $566\frac{21}{25}$
19 $282\frac{31}{33}$
20 $903\frac{17}{28}$
21 $436\frac{11}{38}$
22 $712\frac{7}{16}$
23 $352\frac{9}{19}$
24 $282\frac{15}{29}$
25 $606\frac{17}{31}$
26 $595\frac{12}{13}$
27 $211\frac{9}{11}$
28 $116\frac{2}{17}$
29 $166\frac{7}{15}$
30 $623\frac{3}{23}$
31 $680\frac{1}{21}$
32 $128\frac{16}{17}$
33 $231\frac{3}{8}$
34 $812\frac{7}{16}$
35 $318\frac{11}{32}$
36 $122\frac{9}{16}$
37 $181\frac{35}{47}$
38 $1116\frac{13}{152}$
39 $1364\frac{23}{30}$
40 $1306\frac{8}{75}$

ADDITION—COMMON FRACTIONS

4 eggs + 4 eggs + 4 eggs = 12 eggs, Ans.

$\frac{4}{\text{eggs}}+\frac{4}{\text{eggs}}+\frac{4}{\text{eggs}}=\frac{12}{\text{eggs}}$, Ans.

$\frac{4}{\text{eighths}}+\frac{4}{\text{eighths}}+\frac{4}{\text{eighths}}=\frac{12}{\text{eighths}}$, Ans.

$\frac{4}{8}+\frac{4}{8}+\frac{4}{8}=\frac{12}{8}=1\frac{1}{2}$, Ans.

4 pints + 8 pints + 7 pints = 19 pints, Ans.

$\frac{4}{\text{pints}}+\frac{8}{\text{pints}}+\frac{7}{\text{pints}}=\frac{19}{\text{pints}}$, Ans.

$\frac{4}{\text{fifths}}+\frac{8}{\text{fifths}}+\frac{7}{\text{fifths}}=\frac{19}{\text{fifths}}$, Ans.

$\frac{4}{5}+\frac{8}{5}+\frac{7}{5}=\frac{19}{5}=3\frac{4}{5}$, Ans.

$\frac{4}{11}+\frac{8}{11}+\frac{7}{11}=\frac{19}{11}=1\frac{8}{11}$, Ans.

$\frac{4}{33}+\frac{8}{33}+\frac{7}{33}=\frac{19}{33}$, Ans.

Mental Exercises

Find the sum of the following:

1 $\frac{1}{5}+\frac{3}{5}+\frac{2}{5}+\frac{6}{5}$

2 $\frac{2}{7}+\frac{5}{7}+\frac{4}{7}+\frac{1}{7}$

3 $\frac{5}{12}+\frac{2}{12}+\frac{7}{12}+\frac{9}{12}$

4 $\frac{3}{9}+\frac{5}{9}+\frac{2}{9}+\frac{4}{9}$

5 $\frac{11}{17}+\frac{2}{17}+\frac{3}{17}+\frac{6}{17}$

6 $\frac{2}{11}+\frac{5}{11}+\frac{1}{11}+\frac{3}{11}$

7 $\frac{13}{21}+\frac{2}{21}+\frac{7}{21}+\frac{18}{21}$

8 $\frac{3}{13}+\frac{11}{13}+\frac{7}{13}+\frac{6}{13}$

9 $\frac{1}{15}+\frac{8}{15}+\frac{11}{15}+\frac{4}{15}$

10 $\frac{3}{10}+\frac{7}{10}+\frac{1}{10}+\frac{6}{10}$

11 $\frac{9}{16}+\frac{7}{16}+\frac{8}{16}+\frac{7}{16}$

12 $\frac{3}{27}+\frac{7}{27}+\frac{2}{27}+\frac{4}{27}$

13 $\frac{16}{31}+\frac{3}{31}+\frac{5}{31}+\frac{1}{31}$

14 $\frac{3}{14}+\frac{10}{14}+\frac{7}{14}+\frac{3}{14}$

15 $\frac{11}{25}+\frac{4}{25}+\frac{2}{25}+\frac{6}{25}$

16 $\frac{5}{19}+\frac{3}{19}+\frac{2}{19}+\frac{4}{19}$

17 $\frac{10}{33}+\frac{6}{33}+\frac{7}{33}+\frac{8}{33}$

18 $\frac{1}{23}+\frac{5}{23}+\frac{8}{23}+\frac{7}{23}$

19 $\frac{11}{30}+\frac{5}{30}+\frac{5}{30}+\frac{8}{30}$

20 $\frac{12}{37}+\frac{3}{37}+\frac{7}{37}+\frac{1}{}$

21 $\frac{9}{18}+\frac{5}{18}+\frac{6}{18}+\frac{7}{18}$

22 $\frac{4}{22}+\frac{8}{22}+\frac{6}{22}+\frac{7}{22}$

23 $\frac{3}{30}+\frac{5}{30}+\frac{17}{30}+\frac{8}{30}$

24 $\frac{4}{35}+\frac{2}{35}+\frac{13}{35}+\frac{6}{35}$

25 $\frac{5}{27}+\frac{13}{27}+\frac{15}{27}+\frac{9}{27}$

26 $\frac{4}{16}+\frac{4}{16}+\frac{2}{16}+\frac{8}{16}$

27 $\frac{3}{21}+\frac{6}{21}+\frac{7}{21}+\frac{11}{21}$

28 $\frac{5}{24}+\frac{12}{24}+\frac{19}{24}+\frac{9}{24}$

29 $\frac{4}{20}+\frac{8}{20}+\frac{1}{20}+\frac{1}{20}$

30 $\frac{7}{26}+\frac{3}{26}+\frac{2}{26}+\frac{9}{26}$

31 $\frac{3}{28}+\frac{6}{28}+\frac{8}{28}+\frac{10}{28}$

32 $\frac{2}{12}+\frac{7}{12}+\frac{15}{12}+\frac{9}{12}$

33 $\frac{6}{32}+\frac{7}{32}+\frac{8}{32}+\frac{4}{32}$

34 $\frac{6}{25}+\frac{5}{25}+\frac{13}{25}+\frac{11}{25}$

35 $\frac{5}{15}+\frac{11}{15}+\frac{4}{15}+\frac{5}{15}$

36 $\frac{14}{26}+\frac{4}{26}+\frac{13}{26}+\frac{3}{26}$

37 $\frac{4}{33}+\frac{9}{33}+\frac{12}{33}+\frac{2}{33}$

38 $\frac{5}{39}+\frac{11}{39}+\frac{8}{39}+\frac{2}{39}$

39 $\frac{9}{42}+\frac{8}{42}+\frac{9}{42}+\frac{7}{42}$

40 $\frac{7}{45}+\frac{8}{45}+\frac{8}{45}+\frac{8}{45}$

Observe that the numbers above the line may or may not differ. Observe that the numbers below the line are the same.

The numbers below the line must be the same before the fractions can be added.

Given $\frac{1}{2}+\frac{3}{4}+\frac{1}{3}$. Before the sum can be found, the fractions must be changed to fractions having the same number below the line. (See page 26.)

Twelve is the least number that will contain all the numbers below the lines. Change all the fractions to fractions having 12 below the line.

$$\frac{1}{2}=\frac{6}{12};\ \frac{3}{4}=\frac{9}{12};\ \frac{1}{3}=\frac{4}{12}.$$
$$\frac{1}{2}+\frac{3}{4}+\frac{1}{3}=\frac{6}{12}+\frac{9}{12}+\frac{4}{12}=\frac{19}{12}=1\frac{7}{12},\text{ Ans.}$$

Given $\frac{1}{5}+\frac{3}{4}+\frac{7}{10}$. Twenty is the least number that will contain all the numbers below the lines.

$$\frac{1}{5}=\frac{4}{20};\ \frac{3}{4}=\frac{15}{20};\ \frac{7}{10}=\frac{14}{20}.$$
$$\frac{1}{5}+\frac{3}{4}+\frac{7}{10}=\frac{4}{20}+\frac{15}{20}+\frac{14}{20}+\frac{33}{20}=1\frac{13}{20},\text{ Ans.}$$

Written Exercises

Add the following:

1 $\frac{1}{2}+\frac{3}{5}+\frac{7}{10}$

2 $\frac{5}{6}+\frac{2}{3}+\frac{1}{18}$

3 $\frac{9}{8}+\frac{5}{2}+\frac{4}{4}$

4 $\frac{4}{12}+\frac{8}{4}+\frac{3}{3}$

5 $\frac{2}{5}+\frac{3}{2}+\frac{7}{10}$

6 $\frac{1}{2}+\frac{6}{6}+\frac{2}{3}+\frac{9}{12}$

7 $\frac{5}{30}+\frac{7}{5}+\frac{8}{3}+\frac{1}{15}$

8 $\frac{6}{2}+\frac{4}{18}+\frac{9}{9}+\frac{9}{3}$

9 $\frac{5}{12}+\frac{8}{6}+\frac{3}{24}+\frac{1}{2}$

10 $\frac{7}{10}+\frac{4}{2}+\frac{3}{4}+\frac{2}{20}$

11 $\frac{1}{32}+\frac{6}{16}+\frac{1}{8}+\frac{2}{4}$

12 $\frac{9}{10}+\frac{9}{40}+\frac{5}{20}+\frac{8}{2}$

13 $\frac{5}{6}+\frac{4}{7}+\frac{8}{14}+\frac{4}{42}$

14 $\frac{6}{18}+\frac{7}{6}+\frac{3}{5}+\frac{7}{9}$

15 $\frac{3}{4}+\frac{2}{3}+\frac{6}{12}+\frac{1}{6}$

16 $\frac{1}{4}+\frac{5}{20}+\frac{2}{5}+\frac{9}{10}$

17 $\frac{4}{4}+\frac{9}{16}+\frac{2}{2}+\frac{7}{8}$

18 $\frac{6}{6}+\frac{3}{3}+\frac{8}{9}+\frac{4}{2}$

19 $\frac{5}{4}+\frac{8}{3}+\frac{2}{6}+\frac{7}{2}$

20 $\frac{3}{5}+\frac{5}{4}+\frac{6}{10}+\frac{1}{2}$

21 $\frac{1}{8}+\frac{8}{3}+\frac{5}{6}+\frac{1}{4}$

22 $\frac{9}{10}+\frac{4}{3}+\frac{2}{15}+\frac{7}{2}$

23 $\frac{3}{14}+\frac{3}{2}+\frac{5}{7}+\frac{5}{4}$

24 $\frac{4}{16}+\frac{2}{2}+\frac{5}{8}+\frac{6}{4}$

25 $\frac{8}{3}+\frac{5}{12}+\frac{1}{4}+\frac{7}{9}$

26 $\frac{4}{10}+\frac{3}{4}+\frac{6}{20}+\frac{9}{2}$

27 $\frac{3}{15}+\frac{2}{9}+\frac{8}{5}+\frac{7}{3}$

28 $\frac{1}{6}+\frac{7}{7}+\frac{6}{14}+\frac{4}{3}$

29 $\frac{6}{8}+\frac{5}{16}+\frac{5}{6}+\frac{9}{3}$

30 $\frac{4}{25}+\frac{5}{5}+\frac{8}{2}+\frac{8}{10}$

31 $\frac{7}{20}+\frac{3}{4}+\frac{4}{10}+\frac{9}{2}+\frac{1}{8}$

32 $\frac{7}{6}+\frac{4}{9}+\frac{2}{27}+\frac{3}{2}+\frac{2}{8}$

33 $\frac{5}{2}+\frac{3}{10}+\frac{6}{30}+\frac{1}{6}+\frac{2}{3}$

34 $\frac{6}{16}+\frac{5}{3}+\frac{9}{8}+\frac{1}{6}+\frac{2}{24}$

35 $\frac{4}{2}+\frac{7}{16}+\frac{2}{8}+\frac{3}{4}+\frac{8}{32}$

36 $\frac{7}{25}+\frac{3}{10}+\frac{4}{20}+\frac{3}{5}+\frac{9}{2}$

37 $\frac{4}{4}+\frac{5}{9}+\frac{3}{8}+\frac{4}{3}+\frac{2}{2}$

38 $\frac{6}{4}+\frac{5}{25}+\frac{1}{50}+\frac{1}{2}+\frac{2}{20}$

39 $\frac{5}{4}+\frac{7}{10}+\frac{6}{8}+\frac{7}{2}+\frac{9}{10}$

40 $\frac{1}{4}+\frac{6}{2}+\frac{6}{8}+\frac{7}{5}+\frac{8}{20}$

To find the number to use below the lines, when it is not easy to determine that number by inspection.

Given $\frac{7}{8}+\frac{5}{9}+\frac{20}{24}$.

2)8, 9, 24
2)4, 9, 12
2)2, 9, 6
3)1, 9, 3
3)1, 3, 1
1, 1, 1

Divide by whatever number will go in two or more of the given numbers without a remainder, and continue to do this as long as possible, bringing down any numbers that are not divided. The product of all the divisors is the number to be used below the line.

$2\times2\times2\times3\times3=72.$

$$\frac{7}{8}=\frac{63}{72};\ \frac{5}{9}=\frac{40}{72};\ \frac{20}{24}=\frac{60}{72}.$$

$$\frac{7}{8}+\frac{5}{9}+\frac{20}{24}=\frac{63}{72}+\frac{40}{72}+\frac{60}{72}=\frac{163}{72}=2\frac{19}{72},\text{ Ans.}$$

Given $\frac{11}{15}+\frac{10}{27}+\frac{16}{45}$.

3) 15, 27, 45
5) 5, 9, 15
3) 1, 9, 3
3) 1, 3, 1
1, 1, 1

$3\times5\times3\times3=135.$

$$\frac{11}{15}=\frac{99}{135};\ \frac{10}{27}=\frac{50}{135};\ \frac{16}{45}=\frac{48}{135}.$$

$$\frac{11}{15}+\frac{10}{27}+\frac{16}{45}=\frac{99}{135}+\frac{50}{135}+\frac{48}{135}=\frac{197}{135}=1\frac{62}{135}.\text{ Ans.}$$

Written Exercises

Add the following:

1 $\frac{7}{8}+\frac{9}{28}+\frac{5}{16}$
2 $\frac{3}{14}+\frac{1}{18}+\frac{9}{20}$
3 $\frac{4}{9}+\frac{5}{6}+\frac{8}{15}$
4 $\frac{7}{15}+\frac{4}{21}+\frac{6}{35}$
5 $\frac{6}{7}+\frac{5}{11}+\frac{9}{14}$
6 $\frac{5}{6}+\frac{4}{9}+\frac{7}{24}$
7 $\frac{7}{8}+\frac{3}{10}+\frac{6}{18}$
8 $\frac{2}{5}+\frac{1}{36}+\frac{2}{9}$
9 $\frac{1}{21}+\frac{3}{56}+\frac{9}{84}$
10 $\frac{1}{6}+\frac{3}{8}+\frac{9}{11}$

11 $\frac{2}{3}+\frac{6}{7}+\frac{9}{8}$
12 $\frac{5}{12}+\frac{5}{18}+\frac{7}{24}$
13 $\frac{3}{16}+\frac{5}{24}+\frac{7}{48}$
14 $\frac{7}{12}+\frac{8}{15}+\frac{1}{20}$
15 $\frac{7}{6}+\frac{8}{9}+\frac{6}{13}$
16 $\frac{2}{3}+\frac{5}{7}+\frac{5}{14}$
17 $\frac{9}{4}+\frac{1}{14}+\frac{4}{35}$
18 $\frac{3}{11}+\frac{3}{44}+\frac{7}{16}$
19 $\frac{4}{13}+\frac{2}{39}+\frac{8}{9}$
20 $\frac{9}{17}+\frac{5}{51}+\frac{1}{68}$

21 $\frac{1}{2}+\frac{3}{4}+\frac{5}{6}+\frac{1}{18}$

22 $\frac{3}{4}+\frac{5}{7}+\frac{2}{5}+\frac{9}{10}$

23 $\frac{7}{40}+\frac{1}{120}+\frac{3}{64}+\frac{4}{5}$

24 $\frac{9}{25}+\frac{7}{45}+\frac{3}{55}+\frac{7}{75}$

25 $\frac{7}{16}+\frac{3}{20}+\frac{1}{15}+\frac{9}{35}$

26 $\frac{1}{8}+\frac{9}{14}+\frac{3}{7}+\frac{5}{6}$

27 $\frac{5}{18}+\frac{2}{9}+\frac{5}{54}+\frac{7}{8}$

28 $\frac{7}{12}+\frac{9}{10}+\frac{7}{18}+\frac{5}{24}$

29 $\frac{1}{6}+\frac{2}{3}+\frac{8}{21}+\frac{9}{56}$

30 $\frac{7}{8}+\frac{5}{14}+\frac{12}{35}+\frac{9}{20}$

31 $\frac{6}{17}+\frac{4}{9}+\frac{24}{51}+\frac{1}{3}$

32 $\frac{5}{24}+\frac{7}{18}+\frac{15}{36}+\frac{1}{48}$

33 $\frac{5}{3}+\frac{7}{12}+\frac{9}{10}+\frac{13}{45}$

34 $\frac{4}{21}+\frac{25}{36}+\frac{7}{27}+\frac{8}{18}$

35 $\frac{17}{24}+\frac{9}{20}+\frac{25}{36}+\frac{37}{48}$

36 $\frac{5}{6}+\frac{7}{12}+\frac{1}{18}+\frac{5}{54}$

37 $\frac{7}{16}+\frac{19}{28}+\frac{13}{20}+\frac{3}{40}$

38 $\frac{11}{36}+\frac{5}{18}+\frac{3}{108}+\frac{6}{16}$

39 $\frac{7}{12}+\frac{5}{6}+\frac{19}{42}+\frac{39}{112}$

40 $\frac{2}{9}+\frac{5}{21}+\frac{19}{42}+\frac{41}{126}$

41 A grocer sold $\frac{1}{2}$ dozen eggs to one customer, $\frac{3}{4}$ dozen to another customer, and $\frac{2}{3}$ dozen to Mrs. Smith. How many dozen did he sell?

42 A fisherman caught four fish that weighed as follows: $\frac{3}{8}$ pound, $\frac{1}{3}$ pound, $\frac{9}{10}$ pound, and $\frac{1}{2}$ pound. How much did they all weigh?

43 A lady bought ribbon in three pieces, the first being $\frac{1}{2}$ yard in length and the second being $\frac{17}{18}$ yard in length, and the third being $\frac{7}{8}$ yard in length. How many yards would she have bought in one piece?

44 Mr. Smith worked $\frac{7}{8}$ of a day for A and $\frac{9}{10}$ of a day for B. How long did he work for both?

45 Mr. Adams walked $\frac{5}{6}$ of a mile on Monday, $\frac{7}{8}$ of a mile on Tuesday, $\frac{2}{3}$ of a mile on Wednesday, $\frac{8}{9}$ of a mile on Thurdsay, $\frac{1}{8}$ of a mile on Friday, and $\frac{15}{16}$ of a mile on Saturday. How many miles did he walk during the week?

ADDITION—MIXED NUMBERS

Given $1\frac{5}{8} + 10\frac{8}{9} + 25\frac{7}{36}$.

Add fractions

$$\begin{array}{r} 4)\ \underline{8,\ 9,\ 36} \\ 9)\ \underline{2,\ 9,\ \ 9} \\ 2)\ \underline{2,\ 1,\ \ 1} \\ 1,\ 1,\ \ 1 \end{array}$$

$4 \times 9 \times 2 = 72.$

$\frac{5}{8} = \frac{45}{72};\quad \frac{8}{9} = \frac{64}{72};\quad \frac{7}{36} = \frac{14}{72}.$

$\frac{5}{8} + \frac{8}{9} + \frac{7}{36} = \frac{45}{72} + \frac{64}{72} + \frac{14}{72} = \frac{123}{72} = 1\frac{17}{24}.$

Add integers

$$\begin{array}{r} 1 \\ 10 \\ \underline{25} \\ 36 \end{array}$$

Unite sums

$$\begin{array}{r} 36 \\ \underline{1\frac{17}{24}} \\ 37\frac{17}{24} \end{array}$$

$37\frac{17}{24}$, Ans.

Written Exercises

Add the following:

1 $3\frac{4}{9} + 2\frac{1}{6} + 7\frac{4}{15}$
2 $3\frac{6}{7} + 10\frac{5}{11} + 12\frac{3}{14}$
3 $4\frac{7}{8} + 1\frac{11}{28} + 6\frac{5}{16}$
4 $21\frac{5}{6} + 10\frac{7}{9} + 14\frac{5}{24}$
5 $10\frac{1}{21} + 36\frac{5}{36} + 2\frac{5}{84}$
6 $15\frac{1}{6} + 17 + 8\frac{9}{11}$
7 $8\frac{2}{3} + 9\frac{6}{7} + 26\frac{1}{8}$
8 $3\frac{5}{12} + 4\frac{7}{18} + 9\frac{11}{24}$
9 $7\frac{8}{10} + 18 + \frac{7}{48}$
10 $17\frac{7}{12} + 6\frac{8}{15} + 22$
11 $3\frac{1}{4} + \frac{1}{14} + 10\frac{8}{35}$
12 $14 + 1\frac{7}{51} + 26$
13 $176\frac{6}{17} + 207\frac{5}{9} + 116\frac{27}{51}$
14 $97\frac{4}{21} + 63\frac{29}{36} + 107\frac{13}{27}$
15 $17\frac{1}{6} + 372\frac{2}{3} + 108\frac{11}{21}$
16 $179\frac{1}{2} + 208\frac{3}{4} + 596\frac{5}{6}$
17 $486\frac{7}{8} + 328\frac{3}{14} + 6\frac{11}{15}$
18 $18\frac{4}{13} + 27\frac{5}{39} + 1089\frac{7}{9}$
19 $14\frac{9}{17} + 105\frac{5}{51} + 41\frac{3}{68}$
20 $176\frac{2}{5} + 7\frac{5}{36} + 364\frac{5}{9}$
21 $17\frac{9}{25} + 14\frac{11}{45} + 10\frac{6}{50} + \frac{4}{75}$
22 $7\frac{1}{8} + 18\frac{11}{14} + \frac{5}{7} + 8\frac{5}{6}$
23 $4\frac{6}{17} + 14\frac{7}{9} + 38\frac{29}{51} + \frac{1}{3}$
24 $10\frac{5}{6} + 14\frac{5}{12} + 18\frac{5}{18} + \frac{7}{54}$
25 $8\frac{3}{4} + 105\frac{6}{7} + 32\frac{4}{5} + \frac{9}{10}$
26 $8\frac{8}{15} + \frac{2}{9} + 1\frac{7}{54} + \frac{5}{8}$
27 $26\frac{7}{24} + \frac{11}{18} + 13\frac{11}{36} + \frac{5}{48}$
28 $18\frac{9}{16} + 34 + 7\frac{17}{20} + 92\frac{13}{28}$
29 $400 + 96\frac{7}{120} + 108\frac{17}{64} + 95$
30 $14\frac{7}{12} + 38\frac{7}{10} + 64\frac{7}{18} + \frac{7}{24}$
31 $194 + 361\frac{7}{12} + 96\frac{3}{10} + 180$
32 $19\frac{11}{36} + 400\frac{7}{18} + 368\frac{5}{108} + 36\frac{5}{16}$
33 $87\frac{1}{2} + 1862\frac{1}{4} + 38 + 17\frac{5}{18}$
34 $365\frac{1}{6} + 146\frac{2}{3} + 9 + 14\frac{11}{36}$
35 $92\frac{5}{21} + 1\frac{25}{36} + 107 + \frac{7}{2}$[illegible]
36 $8\frac{7}{12} + 7\frac{5}{6} + 46\frac{19}{21} + 168\frac{11}{12}$
37 $8\frac{7}{16} + 9\frac{3}{20} + 81\frac{4}{35} + 17$
38 $86\frac{5}{8} + 107\frac{9}{14} + 3806 + 1\frac{9}{21}$
39 $92\frac{17}{24} + 20\frac{9}{26} + 36\frac{25}{36} + 48\frac{37}{48}$
40 $19\frac{5}{12} + 73\frac{4}{21} + 316 + \frac{11}{63}$

41 What is the sum of $\$\frac{3}{4}$, $\$107\frac{1}{2}$ and $\$4\frac{1}{4}$?

42 A girl paid $\$4\frac{1}{2}$ for a sled, $\$\frac{1}{2}$ for a book and $\$2\frac{7}{8}$ for a doll. How much did she pay for all her purchases?

43 Farmer Jones planted $5\frac{3}{8}$ acres of potatoes and $2\frac{9}{10}$ acres of corn. How many acres were planted?

44 William had $\$75\frac{3}{4}$, John had $\$9\frac{4}{5}$, and Henry had $\$21\frac{3}{5}$. How much had they altogether?

45 Mr. Brown deposited $\$35\frac{3}{20}$ in a savings-bank during the summer, $\$32\frac{7}{50}$ during the fall, and $\$24\frac{9}{10}$ during the winter. What was the amount of his deposit?

46 A man sold his real estate in three lots: $2\frac{1}{3}$ acres to A, $1\frac{5}{16}$ acres to B and $2\frac{7}{18}$ acres to C. How many acres did he sell?

REDUCTION—COMPOUND NUMBERS

1 Change 50 pounds and 7 ounces to ounces.
1 pound = 16 ounces.
50 pounds = 50 times 16 ounces or 800 ounces.
800 ounces and 7 ounces = 807 ounces, Ans.

2 Change 37 gallons to pints.
1 gallon = 8 pints.
37 gallons = 37 times 8 pints = 296 pints, Ans.

3 Change $\frac{1}{15}$ ton to pounds and ounces.
1 ton = 2000 lb.
$\frac{1}{15}$ ton = $\frac{1}{15}$ of 2000 lb. = $\frac{2000}{15}$ lb. = $133\frac{1}{3}$ lb.
1 lb. = 16 oz.
$\frac{1}{3}$ lb. = $\frac{1}{3}$ of 16 oz. = $\frac{16}{3}$ oz. = $5\frac{1}{3}$ oz.
$\frac{1}{15}$ ton = 133 lb. $5\frac{1}{3}$ oz., Ans.

4 Change .625 bushels to pecks and quarts
1 bu. = 4 pk.
.625 bu. = .625 of 4 pk. = 2.5 pk.
1 pk. = 8 qt.
.5 pk. = .5 of 8 qt. = 4 qt.
.625 bu. = 2 pk. 4 qt., Ans.

5 Change 875 ounces to pounds and ounces.
1 lb. = 16 oz.

In 875 ounces there are as many pounds as 16 oz. is contained times in 875 oz. or 54 times, with 11 oz. remaining; therefore, 875 oz. = 54 lb. 11 oz., Ans.

6 Change 897 pints to gallons, quarts and pints.
1 qt. = 2 pt.

897 pt. ÷ 2 pt. = 448 times with 1 pt. remaining, or 448 qt. 1 pt.

1 gal. = 4 qt.
448 qt. ÷ 4 qt. = 112 times, or 112 gal.
897 pints = 112 gal. 1 pt., Ans.

7 To change 7 quarts to a fraction of a bushel.
1 bu. = 32 quarts.
7 quarts = $\frac{7}{32}$ of 32 quarts.
7 quarts = $\frac{7}{32}$ bu., Ans.

8 To change 125 rd. 5 yd. $2\frac{1}{2}$ ft. to a fraction of a mile.
125 rd. 5 yd. $2\frac{1}{2}$ ft. = 2080 ft.
1 mi. = 5280 ft.
2080 ft. = $\frac{2080}{5280}$ of 5280 ft.
125 rd. 5 yd. $2\frac{1}{2}$ ft. = $\frac{2080}{5280}$ mi. = $\frac{13}{33}$ mi., Ans.

9 To change 7 quarts to a decimal of a bushel.
7 qt. = $\frac{7}{32}$ bu. (See 7.)
$\frac{7}{32}$ bu. = .21875 bu., Ans.

10 To change 125 rd. 5 yd. $2\frac{1}{2}$ ft. to a decimal of a mile.
125 rd. 5 yd. $2\frac{1}{2}$ ft. = $\frac{13}{33}$ mi. (See 8.)
$\frac{13}{33}$ mi. = .3939 + mi., Ans.

Written Exercises

1 Change 34 bu. 2 qt. 1 pt. to pints.
2 " 164 bu. 1 pk. 3 qt. 1 pt. to pints.
3 " 12 gal. 3 qt. 1 pt. 2 gi. to gills.
4 " 1 hhd. 18 gal. 3 gi. to gills.
5 " 14 T. 8 cwt. 16 lb. to pounds.
6 " 3 cwt. 53 lb. 7 oz. to ounces.
7 " 2 ℔. 10 pwt. to grains.
8 " 2 mi. 120 rd. 4 yd. 2 ft. to feet.
9 " 67 rd. 1 ft. 9 in. to inches.
10 " 14 sq. yd. 6 sq. ft. 10 sq. in. to square inches.
11 " 5 A. 125 sq. rd. 10 sq. yd. 2 sq. ft. to square feet.
12 " 3 cu. yd. 12 cu. ft. 1000 cu. in. to cubic inches.
13 " 5 reams, 10 quires, 10 sheets to sheets.
14 " 1 wk. 5 da. 13 hr. 17 min. to minutes.
15 " 6473 pt. to bushels.
16 " 31588 gills to hogsheads.
17 " 303849 oz. to higher denominations.
18 " 192000 gr. " " "
19 " 76170 in. " " "
20 " 93246 sq. in. " " "
21 " 117120 cu. in. " " "
22 " 8964 sheets " " "
23 " 25414 seconds " " "
24 " 10370 feet " " "
25 " 6728 sq. in. " " "
26 " 397 rd. 2 yd. 7 ft. 5 in. to miles.

Change 48963 sq. ft. to acres.
" 979 cu. ft. to cords.
" 119 gal. 3 qt. to hogsheads
" 4 bu. 3 pk. 7 qt. to pints.
How many bu. in 9 cu. ft.?
" " gal. in 5 cu. ft.?
" " bu. of corn in a carload of 28000 lb.?
Change 7286 gr. (Av.) to higher denominations.
How much heavier is an ounce Troy than an ounce Avoirdupois?
How many seconds in 2 wk. 3 da.?
" " weeks from July 1 to Jan. 1?
" " reams in 1000 sheets?
" " pounds in 900 cu. ft. of water?
" " miles in 1.5° of longitude (at the equator)?
Change 3 ft. 7 in. to a fraction of a rod.
" 7 cu. ft. 128 cu. in. to a fraction of a cubic yard.
" 11 hr. 20 min. 40 sec. to a fraction of a day.
" 2 sq. ft. 60 sq. in. to a fraction of a square yard.
" 64 rd. 12 ft. 8 in. to a fraction of a mile.
" 172 cu. in. to a fraction of a cubic foot.
" 3 pk. 7 qt. 1 pt. to a fraction of a bushel.
" 17 gal. 3 qt. 1 pt. 3 gi. to a decimal part of a barrel.
" 22° 40′ 15″ to a decimal part of a circumference.
" 7 doz. 8 units to a decimal part of a gross.

ADDITION—COMPOUND NUMBERS

Add:	13 bu. 3 pk. 3 qt.
	5 bu. 2 pk. 1 qt. 1 pt.
	7 bu. 3 pk. 2 qt. 1 pt.
2 pt. = 1 qt.	25 bu. $\cancel{8}$ pk. 6 qt. $\cancel{2}$ pt.
1 qt. added to 25 bu. 8 pk. 6 qt.	25 bu. $\cancel{8}$ pk. 7 qt.
8 pk. = 2 bu.	25 bu. 8 pk. 7 qt.
2 bu. added to 25 bu. 7 qt. =	27 bu. 7 qt. Ans.
Add:	5 hr. 35 min. 38 sec.
	3 hr. 45 min. 20 sec.
	14 hr. 1 min. 54 sec.
	6 hr. 2 sec.
114 sec. = 1 min. 54 sec.	28 hr. 81 min. $\cancel{114}$ sec.
1 min. 54 sec. added to 28 hr. 81 min. =	28 hr. $\cancel{82}$ min. 54 sec.
82 min. = 1hr. 22 min.	
1 hr. 22 min. added to 28 hr. 54 sec. =	29 hr. 22 min. 54 sec., Ans

Written Exercises

1 Add: 180 bu. 7 qt. 1 pt.; 113 bu. 2 pk. 3 qt.; 17 pk. 2 qt. 1 pt.; 31 bu. 1 pt.; 25 bu. 2 pk. 2 qt.

2 Add: 4 gal. 2 qt. 1 pt. 3 gi; 2 gal. 1 qt. 2 gi.; 1 gal. 1 qt. 1 pt. 1 gi.; 3 gal. 1 pt.

3 Add: 1 T. 14 cwt. 17 lb. 10 oz; 5 T. 4 cwt. 6 oz.; 10 T. 6 cwt. 36 lb. 12 oz.; 14 T. 8 oz.

4 Add: 2 mi. 160 rd. 4 yd. 1 ft. 10 in.; 18 mi. 100 rd. 2 yd. 2 ft. 10 in.; 26 mi. 50 rd. 5 yd. 2 ft. 1 in.

5 Add: 7 A. 130 sq. rd. 6 sq. yd. 2 sq. ft. 10 sq. in.; 14 A. 16 sq. rd. 3 sq. yd. 2 sq. ft. 18 sq. in.; 62 A. 17 sq. rd. 18 sq. yd. 1 sq. ft.

6 Add: 7 cd. 4 cd. ft. 6 cu. ft. 10 cu. in.; 4 cd. 2 cd. ft. 7 cu. ft. 6 cu. in.; 8 cd. 15 cu. ft. 11 cu. in.

7 How much oil could be put into four tanks, if the first held 5 hhd. 17 gal. 2 qt. 1 pt.; the second, 2 hhd. 3 gal. 3 gi; the third, 4 hhd. 29 gal. 3 qt. 1 pt. 2 gi.; the fourth, 4 hhd. 50 gal. 1 qt.?

8 One bar of silver weighed 2 ℔. 10 oz. 4 pwt.; the second, 3 ℔. 1 oz. 2 pwt. 10 gr.; the third, 5 lb. 5 pwt. 5 gr. How much did all three weigh together?

9 A ship made a certain voyage in 20 da. 15 hr. 35 min. 7 sec.; on the return, it took 27 da. 12 hr. 43 min. 10 sec.; on the next trip, 24 da. 2 hr. 4 min. 20 sec.; and on the return, 18 da. 15 hr. 5 min. Find total time taken for the four trips

10 Find the entire distance around a field, if one side measures 10 rd. 3 yd. 2 ft. 6 in.; the second, 5 rd. 4 yd. 1 ft. 10 in.; the third, 9 rd. 1 yd. 1 ft. 9 in.; and the fourth, 6 rd. 5 yd. 2 ft. 4 in.

SUBTRACTION—INTEGERS

$$\begin{array}{r}3587\\1435\\\hline 2152\end{array}$$

A good way to insure accuracy after the subtraction has been performed is to add the remainder and the number subtracted, to see that the sum equals the number taken from.

Usual method:

$$\begin{array}{r}243\\\cancel{3}\cancel{5}\cancel{4}6\\1787\\\hline 1759\end{array}$$

7 units cannot be taken from 6 units; therefore take 1 ten from 4 tens, leaving 3 tens; change it to 10 units and add to 6, making 16; 7 from 16 = 9. 8 tens cannot be taken from 3 tens; therefore take 1 hundred from 5 hundreds, leaving 4 hundreds; change it to 10 tens and add to 3 tens, making 13 tens; 8 from 13 = 5. A similar process gives: 7 hundreds from 14 hundreds = 7 hundreds. 1 thousand from 2 thousands = 1 thousand.

Alternative method:

$$\begin{array}{r}3546\\1787\\\hline 1759\end{array}$$

When it is necessary to take one from the next digit (i. e., taking 7 from 16), increase by one the next figure subtracted, giving 9 in the place of 8; then 9 from 14, 8 from 15 and 2 from 3. Prove as in preceding example.

The foregoing suggestions should be practised until they are fixed habits.

Much practice, long continued, is the best means of assuring accuracy.

Written Exercises

1 From 9367001 take 439216.

2 From 1001673 take 67198.

3 From 376174 take 298786.

4 From 913000 take 468913.

5 Take 427683 from 813276.

6 From 38964 lb. of coal, a dealer sold 17896 lb. How much remained?

7 How much larger is 1673279 than 964817?

8 One train ran 364117 ft. while a second train was running 176246 ft. How much farther did the first run than the second?

9 The population of a certain city increased from 1603214 in 1890 to 2014617 in 1900. How much was the increase?

10 113614 letters were mailed from a post office one day and 18916 less the second day. How many were mailed the second day?

11 From a reservoir containing 1364713 gal., 188229 gal. were drawn off. How many gallons remained?

12 A man who had $672104 lost $317916 by speculation. How much had he left?

13 How much must be added to 136417 lb. to make 203128 lb.?

14 What is the difference between 17601732 and 217614?

15 What is the difference between 3189163 and 4361748?

16 After taking 4196731 from 5321789, what remains?

17 By how much must 82176 be increased to equal 324817?

18 How much smaller is 138273 than 264921?

19 Take 56789 from 100000.

20 Of a shipment of 20170 lb. of potatoes, 2398 lb. were frozen in transit. How much remained?

SUBTRACTION—DECIMALS

In subtraction of decimals, the figures should be written in even vertical columns with decimals points under each other.

Subtract as in integers, placing the decimal point in the difference beneath the decimal point in the numbers subtracted.

14.682	13.0003	15.
1.075	11.	7.0085
13.607, Ans.	2.0003, Ans.	7.9915, Ans.

Written Exercises

1 From 505 and 1 thousandth take 55 and 1 ten-thousandth.

2 Take 673.014 from 1086.192.

3 Take 2020.202 from 10203.0405.

4 What is the difference between 437 thousand and 437 millionths?

5 Find the difference between three hundred seventy and six thousandths and five hundred thirty-eight ten-thousandths.

6 B's farm contains 36.2046 acres less than A's, which contains 416.0012 acres. How many acres in B's farm?

7 The sum of two numbers is 164.01738 and the larger one is 123.617896. Find the smaller number.

8 How much must be added to 333.444 to make 1000?

9 Find the difference between thirteen thousand eight and fifteen thousand four hundred-thousandths.

10 How much farther does A, who travels 34.7064 miles, go than B, who travels 29.0796 miles?

11 The greater of two numbers is 164.03724 and their difference is 36.172498. What is the smaller number?

12 Subtract 333 thousandths from 333 thousand.

13 A man traveled 100 miles in 3 days. The first two days he traveled 70.1375 miles. How far did he go the third day?

14 While A is travelling 176.4875 miles, B goes 146.0035 miles in the same direction. How far apart are they at the end of that time?

15 Take four thousand eight hundred-thousandths from seventy-five and five tenths.

16 From 1.00176 take .001243.

SUBTRACTION—UNITED STATES MONEY

This is an application of subtraction of decimals.

In subtracting, dollars must be placed under dollars, cents under cents, mills under mills, etc.

Use great care in writing the numbers to be subtracted.

$185.76	$157.	$176.1457
24.85	75.36	3.3914
$160.91, Ans.	$ 81.64, Ans.	$172.7543, Ans.

Written Exercises

1 From $638.67 take $85.495.

2 From $175. take $68.092.

3 Take $625.625 from $1595.375.

4 What is the difference between $900 and 900 mills?

5 How much change is left from a 100 dollar bill after purchasing goods worth $69.98?

6 I sold a horse for $164.25 gaining $39.14. How much did it cost me?

7 In one week, goods costing $834.92 were sold for $983.17. How much was the week's profit?

8 I deposited in a bank $362.24 and drew out $76.79. How much remained?

9 A man left to his widow $3874.30, while to his son he left $2804.06. How much more did the widow receive than the son?

10 How much must be added to $377.84 already in a bank to make the whole deposit $1000?

SUBTRACTION—COMPOUND NUMBERS

Illustrations:

Subtract:

$$\begin{array}{r}
13\text{ bu. }3\text{ pk. }3\text{ qt.}\\
5\text{ bu. }2\text{ pk. }1\text{ qt.}\\
\hline
8\text{ bu. }1\text{ pk. }2\text{ qt., Ans.}
\end{array}$$

It is impossible to take 45 min. from 35 min. so 1 hr. is taken from 5 hr. leaving 4 hr.

$$\begin{array}{lll}
4 & 95 & \\
\cancel{5}\text{ hr.} & \cancel{35}\text{ min.} & 38\text{ sec.}\\
3\text{ hr.} & 45\text{ min.} & 20\text{ sec.}\\
\hline
1\text{ hr.} & 50\text{ min.} & 18\text{ sec.}
\end{array}$$

1 hr. = 60 min. 60 min. + 35 min. = 95 min.

It is impossible to take 23 gr. from 4 gr., so 1 pwt. is borrowed from 15 pwt., leaving 14 pwt.

$$\begin{array}{lll}
 & 34 & \\
13 & \cancel{14} & 28\\
\cancel{14}\text{ oz.} & \cancel{15}\text{ pwt.} & \cancel{4}\text{ gr}\\
9\text{ oz.} & 19\text{ pwt.} & 23\text{ gr.}\\
\hline
4\text{ oz.} & 15\text{ pwt.} & 5\text{ gr., Ans.}
\end{array}$$

1 pwt. = 24 gr.
24 gr. + 4 gr. = 28 gr.

It is impossible to take 19 pwt. from 14 pwt., so 1 oz. is taken from 14 oz., leaving 13 oz.

1 oz. = 20 pwt. 20 pwt. + 14 pwt. = 34 pwt.

Written Exercises

1 From 17 ℔. 10 oz. 15 pwt. 19 gr. take 12 ℔. 13 oz. 16 pwt. 18 gr.

2 From 5℔. 7℥. take 2℔. 9℥. 6ʒ.

3 From 7 mi. 178 rd. 3 yd. 8 in. take 4 mi. 140 rd. 3 yd. 1 ft. 7 in.

4 28 gal. 2 qt. 1 pt. leaked from a barrel of vingear which formerly held 33 gal. 3 qt. 1 pt. How much remained?

5 From $\frac{5}{8}$ mi. take 78.56 rd.

6 From $\frac{5}{8}$ wk. take $\frac{4}{5}$ da.

7 From .9 mi. take 210 rd. 3 yd. 9 in.

8 From $\frac{3}{5}$ of a gallon take $1\frac{7}{8}$ qt.

9 A barrel containing 35 gal. leaked 4 gal. 3 qt. during transportation. How much remained?

10 How *much* has a barrel leaked that formerly held $36\frac{1}{4}$ gal., *if there remains* but $18\frac{1}{2}$ quarts?

SUBTRACTION—COMMON FRACTIONS

1 7 eggs − 4 eggs = 3 eggs, Ans.

$$\frac{7}{\text{eggs}} - \frac{4}{\text{eggs}} = \frac{3}{\text{eggs}}, \text{ Ans.}$$

$$\frac{7}{\text{eighths}} - \frac{4}{\text{eighths}} = \frac{3}{\text{eighths}}, \text{ Ans.}$$

$\frac{7}{8} - \frac{4}{8} = \frac{3}{8}$, Ans.

2 9 pints − 7 pints = 2 pints, Ans

$$\frac{9}{\text{pints}} - \frac{7}{\text{pints}} = \frac{2}{\text{pints}}, \text{ Ans.}$$

$$\frac{9}{\text{twelfths}} - \frac{7}{\text{twelfths}} = \frac{2}{\text{twelfths}}, \text{ Ans.}$$

$\frac{9}{12} - \frac{7}{12} = \frac{2}{12} = \frac{1}{6}$, Ans.

3 $\frac{19}{20} - \frac{7}{20} = \frac{12}{20} = \frac{3}{5}$, Ans.

4 $\frac{4}{15} - \frac{2}{15} = \frac{2}{15}$, Ans.

Observe that the numbers above the line may or may not differ
Observe that the numbers below the line are the same.

Mental Exercises

Subtract the following:

1 $\frac{7}{9} - \frac{2}{9}$
2 $\frac{8}{11} - \frac{3}{11}$
3 $\frac{7}{12} - \frac{2}{12}$
4 $\frac{13}{15} - \frac{11}{15}$
5 $\frac{7}{13} - \frac{6}{13}$
6 $\frac{5}{6} - \frac{1}{6}$
7 $\frac{7}{18} - \frac{4}{18}$
8 $\frac{13}{16} - \frac{9}{16}$
9 $\frac{18}{25} - \frac{3}{25}$
10 $\frac{10}{14} - \frac{3}{14}$
11 $\frac{9}{10} - \frac{4}{10}$
12 $\frac{14}{19} - \frac{11}{19}$
13 $\frac{23}{35} - \frac{8}{35}$
14 $\frac{20}{28} - \frac{6}{28}$
15 $\frac{17}{18} - \frac{8}{18}$
16 $\frac{23}{42} - \frac{9}{42}$
17 $\frac{13}{20} - \frac{8}{20}$
18 $\frac{11}{36} - \frac{5}{36}$
19 $\frac{17}{23} - \frac{13}{23}$
20 $\frac{33}{45} - \frac{23}{45}$
21 $\frac{23}{24} - \frac{1}{24}$
22 $\frac{9}{32} - \frac{5}{32}$
23 $\frac{19}{21} - \frac{12}{21}$
24 $\frac{11}{64} - \frac{3}{64}$
25 $\frac{21}{38} - \frac{2}{38}$
26 $\frac{37}{48} - \frac{5}{48}$
27 $\frac{19}{22} - \frac{17}{22}$
28 $\frac{61}{63} - \frac{19}{63}$
29 $\frac{23}{56} - \frac{15}{56}$
30 $\frac{39}{40} - \frac{27}{40}$

The numbers below the line must be the same before the fractions can be subtracted.

1 Given $\frac{5}{8}-\frac{7}{12}$. Before the difference can be found, the fractions must be changed to fractions having the same number below the line.

Twenty-four is the least number that will contain both numbers below the line.

$\frac{5}{8}=\frac{15}{24}$; $\frac{7}{12}=\frac{14}{24}$.
$\frac{5}{8}-\frac{7}{12}=\frac{15}{24}-\frac{14}{24}=\frac{1}{24}$, Ans.

2 Given $\frac{45}{120}-\frac{17}{60}$. 120 is the least number that will contain both numbers below the line.

$\frac{45}{120}=\frac{45}{120}$; $\frac{17}{60}=\frac{34}{120}$.
$\frac{45}{120}-\frac{17}{60}=\frac{45}{120}-\frac{34}{120}=\frac{11}{120}$, Ans.

Written Exercises

Subtract:

1 $\frac{19}{24}-\frac{3}{16}$
2 $\frac{7}{8}-\frac{5}{12}$
3 $\frac{11}{15}-\frac{7}{45}$
4 $\frac{8}{9}-\frac{7}{30}$
5 $\frac{3}{4}-\frac{7}{15}$
6 $\frac{2}{3}-\frac{1}{9}$
7 $\frac{11}{18}-\frac{7}{27}$
8 $\frac{1}{14}-\frac{1}{42}$
9 $\frac{10}{13}-\frac{19}{39}$
10 $\frac{45}{52}-\frac{2}{13}$
11 $\frac{18}{16}-\frac{21}{40}$
12 $\frac{5}{12}-\frac{3}{20}$
13 $\frac{2}{3}-\frac{7}{12}$
14 $\frac{5}{6}-\frac{7}{9}$
15 $\frac{3}{11}-\frac{1}{5}$
16 $\frac{25}{32}-\frac{25}{48}$
17 $\frac{17}{24}-\frac{23}{36}$
18 $\frac{11}{18}-\frac{11}{24}$
19 $\frac{11}{12}-\frac{7}{8}$
20 $\frac{3}{5}-\frac{7}{12}$
21 $\frac{35}{44}-\frac{17}{33}$
22 $\frac{6}{35}-\frac{1}{14}$
23 $\frac{11}{18}-\frac{4}{15}$
24 $\frac{15}{22}-\frac{1}{33}$
25 $\frac{7}{9}-\frac{5}{24}$
26 $\frac{7}{12}-\frac{7}{20}$
27 $\frac{29}{35}-\frac{4}{7}$
28 $\frac{5}{27}-\frac{1}{6}$
29 $\frac{17}{18}-\frac{8}{9}$
30 $\frac{19}{24}-\frac{11}{16}$
31 $\frac{14}{15}-\frac{19}{25}$
32 $\frac{7}{15}-\frac{1}{6}$
33 $\frac{53}{60}-\frac{23}{30}$
34 $\frac{3}{17}-\frac{8}{51}$
35 $\frac{71}{80}-\frac{15}{32}$
36 $\frac{97}{105}-\frac{31}{35}$
37 $\frac{431}{625}-\frac{32}{125}$
38 $\frac{170}{250}-\frac{75}{125}$
39 $\frac{69}{75}-\frac{99}{225}$
40 $\frac{12}{144}-\frac{144}{1728}$

To find the number to use below the lines when it is not easy to determine that number by inspection. (See same subject under addition of common fractions.)

1 Given $\frac{15}{27}-\frac{11}{45}$.

3)27, 45
3) 9, 15
3) 3, 5
5) 1, 5
1

$3\times3\times3\times5=135$

$\frac{15}{27}=\frac{75}{135}$; $\frac{11}{45}=\frac{33}{135}$.

$\frac{15}{27}-\frac{11}{45}=\frac{75}{135}-\frac{33}{135}=\frac{42}{135}$, Ans.

2 Given $\frac{25}{42}-\frac{7}{64}$.

$$\begin{array}{r|l} 2 & 42,\ 64 \\ \hline 21 & 21,\ 32 \\ \hline 32 & \ \ 1,\ 32 \\ \hline & \ \ 1,\ \ \ 1 \end{array}$$

$2\times21\times32=1344$

$\frac{25}{42}=\frac{800}{1344}$; $\frac{7}{64}=\frac{147}{1344}$.

$\frac{25}{42}-\frac{7}{64}=\frac{800}{1344}-\frac{147}{1344}=\frac{653}{1344}$, Ans.

Written Exercises

1 $\frac{14}{17}-\frac{5}{51}$
2 $\frac{19}{20}-\frac{7}{16}$
3 $\frac{8}{21}-\frac{1}{6}$
4 $\frac{9}{14}-\frac{3}{8}$
5 $\frac{21}{33}-\frac{1}{7}$
6 $\frac{19}{42}-\frac{5}{21}$
7 $\frac{25}{36}-\frac{7}{24}$
8 $\frac{7}{18}-\frac{1}{5}$
9 $\frac{19}{64}-\frac{1}{12}$
10 $\frac{23}{45}-\frac{4}{25}$
11 $\frac{39}{84}-\frac{3}{56}$
12 $\frac{11}{13}-\frac{2}{9}$
13 $\frac{7}{16}-\frac{3}{11}$
14 $\frac{48}{49}-\frac{11}{14}$
15 $\frac{19}{20}-\frac{2}{5}$
16 $\frac{10}{11}-\frac{5}{6}$
17 $\frac{14}{39}-\frac{7}{65}$
18 $\frac{33}{40}-\frac{5}{12}$
19 $\frac{17}{25}-\frac{8}{24}$
20 $\frac{9}{16}-\frac{4}{15}$
21 $\frac{37}{50}-\frac{6}{125}$
22 $\frac{17}{27}-\frac{8}{63}$
23 $\frac{64}{96}-\frac{4}{6}$
24 $\frac{18}{35}-\frac{3}{28}$
25 $\frac{23}{42}-\frac{5}{28}$

26 A can do $\frac{11}{15}$ of a piece of work in one day, and B can do $\frac{5}{9}$ of it in one day. How much more can A do than B?

27 A piece of cloth $\frac{7}{8}$ yard long shrinks $\frac{1}{3}$ yard in dyeing. How long is it then?

28 While a train is going $\frac{7}{16}$ of a mile, a horse travels $\frac{7}{24}$ of a mile. How much farther does the train travel than the horse?

29 Mr. Jones used $\frac{7}{18}$ of his yard for a tennis court. How much remained?

30 From $\frac{17}{36}$ yard of cloth, $\frac{17}{54}$ yard was sold. How much remained?

SUBTRACTION—MIXED NUMBERS

1 Given $5\frac{5}{8}-3\frac{1}{4}$.

Subtract fractions: $\frac{5}{8}-\frac{1}{4}=\frac{5}{8}-\frac{2}{8}=\frac{3}{8}$

Subtract integers: $5-3=2$

Unite remainders: 2 and $\frac{3}{8}=2\frac{3}{8}$, Ans.

2 Given $105\frac{1}{12}-99\frac{5}{9}$.

Subtract fractions: $\frac{1}{12}-\frac{5}{9}=\frac{3}{36}-\frac{20}{36}$

It is impossible to take $\frac{20}{36}$ from $\frac{3}{36}$; so one is borrowed from 105 leaving 104.

$1=\frac{36}{36}$; $\frac{36}{36}+\frac{3}{36}=\frac{39}{36}$; $\frac{39}{36}-\frac{20}{36}=\frac{19}{36}$

Subtract integers: $104-99=5$

Unite remainders: 5 and $\frac{19}{36}=5\frac{19}{36}$, Ans.

Written Exercises

1 $7\frac{2}{9}-3\frac{1}{9}$
2 $4\frac{7}{8}-1\frac{3}{8}$
3 $12\frac{3}{5}-7\frac{3}{10}$
4 $21\frac{7}{11}-11\frac{3}{22}$
5 $13\frac{3}{4}-6\frac{2}{3}$
6 $17\frac{1}{3}-7\frac{2}{3}$
7 $9\frac{1}{5}-8\frac{4}{5}$
8 $29\frac{1}{3}-10\frac{3}{4}$
9 $18\frac{3}{7}-6\frac{4}{5}$
10 $20\frac{13}{32}-13\frac{5}{12}$
11 From $64\frac{3}{16}$ take $27\frac{1}{12}$
12 From $47\frac{1}{11}$ take $15\frac{1}{4}$
13 From $82\frac{3}{8}$ take $57\frac{7}{11}$
14 From $53\frac{3}{16}$ take $23\frac{3}{24}$
15 Subtract $3\frac{9}{10}$ from $10\frac{2}{25}$
16 Subtract $16\frac{1}{2}$ from $30\frac{3}{32}$
17 Subtract $95\frac{11}{12}$ from $101\frac{7}{27}$
18 Subtract $60\frac{4}{15}$ from $63\frac{2}{35}$
19 Subtract $41\frac{11}{12}$ from $50\frac{13}{15}$
20 Subtract $16\frac{17}{64}$ from $30\frac{19}{20}$

21 A piece of cloth containing $27\frac{7}{8}$ yd. was found to have shrunk $2\frac{5}{6}$ yd. in dyeing. How many yd. did it measure after shrinking?

22 How many yards of a 50-yd. web of cotton cloth remain after $17\frac{5}{8}$ yd. have been sold to A and $19\frac{5}{6}$ yd. have been sold to B?

23 A man gave the grocer a ten-dollar bill in payment for provisions amounting to \$$7\frac{5}{8}$. How much change was due the man?

24 On Monday four lads hoed $1\frac{5}{6}$ acres of potatoes. If they hoed $\frac{7}{8}$ of an acre in the forenoon, how much did they hoe in the afternoon?

25 A man owning $47\frac{5}{9}$ acres of land, sold $7\frac{1}{3}$ acres to A, and $24\frac{5}{6}$ acres to B. How many acres had he left?

26 A man having \$$85\frac{5}{10}$, spends \$$33\frac{2}{5}$ for carfare and \$$23\frac{3}{4}$ for hotel bills. How much has he left?

MULTIPLICATION—INTEGERS

The result of a multiplication is called the **product.**

Illustrations:

I. To multiply 73214 by 2

73214
2
146428, Ans.

II. To multiply 13472 by 2

2 times 7 = 14. Write the 4 and carry the 1.
2 times 4 = 8. 8 and 1 = 9.

13472
2
26944, Ans.

III. To multiply 34562 by 24

34562
24

Multiplying by 4, 138248
Multiplying by 2, 69124
Adding partial products, 829488, Ans.

Observe that the right hand figure of the partial product is placed beneath the figure by which we multiply.

IV. To multiply 48276 by 2700

When the number by which we multiply, ends in ciphers, place the ciphers at the right and simply bring them down.

48276
2700
33793200
96552
130345200, Ans.

V. To multiply 85432 by 5007

When the number by which we multiply contains ciphers, it is not necessary to multiply by them.

85432
5007
598024
427160
427758024, Ans.

The foregonig suggestions should be practised until they are fixed habits.

Much practice, long continued, is the best means of assuring accuracy.

To find the product is to multiply. To multiply is to find the product.

To multiply by 10, 100, 1000, etc.

Illustration:

I. To multiply 3568 by 10, by 100, and by 1000.

3568	3568	3568
10	100	1000
35680, Ans.	356800, Ans.	3568000, Ans.

Observe that in multiplying by 10, the decimal point is moved **one** place to the right; that in multiplying by 100 the decimal point is moved **two** places to the right; that in multiplying by 1000 the decimal point is moved **three** places to the right.

8345. × 100. = 834500.

5684. × 1000. = 5684000.

Written Exercises

1 467 × 4 =
2 896 × 10 =
3 2764 × 38 =
4 1764 × 136 =
5 2007 × 407 =
6 75469 × 316 =
7 91006 × 1764 =
8 67107 × 1903 =
9 9872 × 43 =
10 7415 × 906 =
11 3746 × 417 =
12 4736 × 14 =
13 5176 × 4796 =
14 3708 × 1075 =
15 197 × 182 =
16 31765 × 100 =
17 97006 × 4713 =
18 4217 × 169 =
19 8952 × 909 =
20 97641 × 1764 =
21 9999 × 5555 =
22 27615 × 307 =
23 4173 × 9876 =
24 6514 × 9302 =
25 17654 × 87 =
26 9873 × 1410 =
27 36705 × 1000 =
28 176514 × 80706 =
29 4131761 × 4070 =
30 1936147 × 74069 =

31 What is the value of 1576 tons of hay at $17 per ton?

32 If 164 bushels of potatoes can be raised on 1 acre, how many bushels can be raised on 100 acres?

33 If a pipe discharges 314 gallons of water per minute, how many gallons will it discharge in 75 minutes?

34 How many words are there in 37 columns, if each column contains 56714 words?

35 A mile contains 5280 feet. How many feet are there in 74 miles?

36 If each soldier in an army carried 73 lb., how many lb. are carried by a regiment of 946 men?

37 What is the weight of 317 bales of cotton, if each bale weighs 384 lb?

38 A long ton of coal contains 2240 lb. How many lb. are there in 8719 tons?

39 If a stenographer can write 127 words per minute, how many words can he write in 469 minutes?

40 If a barrel of flour weighs 196 lb., how many lb. does a consignment of 1000 barrels weigh?

MULTIPLICATION—DECIMALS

The process of multiplication of decimals does not differ from the process of multiplication of integers except in the placing of the decimal point in the product, and this is all-important.

Place the decimal point in the product as many places toward the left as there are decimal places in both numbers multiplied.

Illustrations:

I. To multiply 4.827 by 12. There are three decimal places in both numbers multiplied.

Place the decimal point three places toward the left.

4.827
12
9654
4827
57.924, Ans.

II. To multiply 4653. by 2.17. There are two decimal places in both numbers multiplied.

Place the decimal point two places toward the left.

4653.
2.17
32571
4653
9306
10097.01, Ans.

III. To multiply 1.0765 by .0004.

There are eight decimal places in both numbers multiplied.
Place the decimal point eight places toward the left.

1.0765
.0004
.00043060, Ans.

Written Exercises

1 197.6×.41=
2 18.731×.507=
3 10.014×6.005=
4 176.9104×.037=
5 .05732×.0108=
6 13.0145×20.07512=
7 98.005×.003=
8 60.195×186.=

9 Multiply twenty-five thousand by twenty-five thousandths

10 Multiply two hundred thousand by two hundred-thousandths

11 Multiply one thousand and six ten-thousandths by forty and two thousandths.

12 Multiply eight thousand five and four-tenths by four hundredths.

13 If one acre produces 54.05 bushels of potatoes, how many bushels will 43.985 acres produce?

14 If a train runs 26.4375 miles per hour, how far will it go in 7.08 hours?

15 Two vessels sail in opposite directions, one at the rate of 10.732 miles per hour and the other 14.315 miles per hour. How far apart are they at the end of 16.071 hours?

16 A owns 43.019 acres of land and B owns 6.305 times as much. How much does B own?

17 A field is 373.058 yd. long and 173.19 yd. wide. How many sq. yd. are there in the field? (Multiply.)

18 Two men start from the same place, walking in the same direction, one at the rate of 4.106 miles per hour, and the other 5.372 miles per hour. How far apart are they at the end of 3.0175 hours?

19 How many acres can a man mow in 7.553 days at the rate of 3.106 acres per day?

20 How many gallons of water will 63.176 barrels hold, if each barrel holds 53.007 gallons?

MULTIPLICATION—UNITED STATES MONEY

This is an application of multiplication of decimals. Multiply and point off as in decimals.

Illustrations:

I. To multiply $4684. by 13.

$4684.
13.
14052
4684
$60892., Ans.

II. To multiply $47.48 by 22.

$47.48
22
9496
9496
$1044.56, Ans.

III. To multiply $48.37 by 2.5

$48.37
2.5
24185
9674
$120.925, Ans.

IV. To multiply $25.1426 by 13.2

$25.1426
13.2
502852
754278
251426
$331.88232, Ans.

Written Exercises

1 Multiply $19.625 by 43.
2 Multiply $265.041 by 108.
3 Multiply $8173.092 by 9007.
4 *Find the* value of 376 acres of land at $163.75 per acre.

5 What is the value of 5.09 tons of coal at $6.75 per ton?

6 What is the value of 8 piles of wood, each containing 6.7 cords, at $9.625 per cord?

7 Find the cost of 36473 feet of lumber at $.025 per foot.

8 Find the value of 71 bushels of potatoes at $.625 per bushel.

9 How much does a lot of land containing 6300 sq. ft. cost me at the rate of $.258 per square foot?

10 How much pay is due a laborer for 4 days' work, 8.375 hours per day, at the rate of $.185 per hour?

11 Which costs more, 12316 feet of land at 26 cents per foot, or 11764 feet at $.265 per foot?

12 Find the cost of 32 boxes of soap, each box containing 100 bars, at the rate of $.083 per bar?

13 What is the value of three carloads of sugar, each containing 63 barrels, each barrel weighing 200 lb., worth 7½ cents per lb.?

14 Four carpenters built a house working 8.5 hours per day 6 days per week, for 14 weeks. Find the total amount of their wages at the rate of $.375 per hour.

15 At the rate of $.115 per dozen, how much is paid for 63 boxes of oranges, each box containing 12 dozen oranges?

16 If one bushel of potatoes cost $.725, what will 238 bushels cost?

17 A fifty-trip ticket between two places cost 22½ cents per trip. What is the price of the whole ticket?

18 What will be paid, at the rate of 30¼ cents per square foot for a lot containing 12675 sq. ft.?

19 Find the value of 643 barrels of apples, each barrel being worth $2.625.

20 What will be the cost of 814 square yards of concrete sidewalk, the price per square yard being 41⅛ cents?

MULTIPLICATION—COMMON FRACTIONS

"Of" and "times" indicate multiplication.

A fraction by an integer

Illustrations:

I. 2 times 3 quarts = 6 quarts, Ans.

$2 \text{ times } \dfrac{3}{\text{quarts}} = \dfrac{6}{\text{quarts}}$, Ans.

2 times $\frac{3}{4} = \frac{6}{4} = 1\frac{1}{2}$, Ans.

II. 3 times $\frac{8}{9} = \frac{24}{9} = 2\frac{2}{3}$, Ans.
III. 5 times $\frac{7}{8} = \frac{35}{8} = 4\frac{3}{8}$, Ans.
IV. 7 times $\frac{81}{95} = \frac{567}{95} = 5\frac{92}{95}$, Ans.
V. $\frac{8}{15} \times 7 = \frac{56}{15} = 3\frac{11}{15}$, Ans.
VI. $\frac{8}{13} \times 6 = \frac{48}{13} = 3\frac{9}{13}$, Ans.
VII. $\frac{10}{2} \times 7 = \frac{70}{2} = 35$, Ans.

Written Exercises

1 $\frac{5}{9}$ of 3 =
2 $\frac{7}{10}$ of 9 =
3 $\frac{4}{5}$ of 15 =
4 $\frac{11}{12}$ of 21 =
5 $\frac{3}{7}$ of 11 =
6 $\frac{12}{13} \times 40 =$
7 $\frac{9}{11} \times 17 =$
8 $\frac{13}{15} \times 45 =$
9 $\frac{9}{16} \times 22 =$
10 $\frac{21}{23} \times 7 =$
11 $\frac{24}{25} \times 18 =$
12 $\frac{11}{13} \times 12 =$
13 $\frac{5}{24} \times 35 =$
14 $\frac{5}{18} \times 29 =$
15 $\frac{4}{15} \times 14 =$
16 $\frac{11}{24} \times 65 =$
17 $\frac{7}{16} \times 77 =$
18 $\frac{9}{22} \times 43 =$
19 $\frac{2}{25} \times 81 =$
20 $\frac{14}{15} \times 71 =$
21 $\frac{36}{43} \times 10 =$
22 $\frac{11}{15} \times 31 =$
23 $\frac{6}{25} \times 17 =$
24 $\frac{9}{13} \times 290 =$
25 $\frac{16}{21} \times 215 =$
26 $\frac{4}{11} \times 796 =$
27 $\frac{9}{58} \times 27 =$
28 $\frac{13}{17} \times 525 =$
29 $\frac{17}{53} \times 98 =$
30 $\frac{19}{23} \times 139 =$

Find the cost of:

31 12 yd. flannel at \$$\frac{3}{8}$ a yd.
32 7 doz. oranges at \$$\frac{3}{10}$ a doz.
33 15 lb. coffee at \$$\frac{7}{10}$ a lb.
34 126 lb. beef at \$$\frac{2}{9}$ a lb.
35 17 bu. corn at \$$\frac{9}{10}$ a bu.
36 When apples are worth \$$\frac{7}{8}$ a bushel, what are 112 bu. worth?
37 *If a family* consumes $\frac{11}{12}$ lb. of coffee in a week, how many *pounds will be* consumed in 17 weeks?

38 If a train goes $\frac{13}{16}$ of a mile a minute, how far will it go 27 minutes?

39 A wheel goes forward $\frac{24}{25}$ of a yard in making one revolutio How far will it go in making 249 revolutions?

40 A boy goes $\frac{7}{8}$ of a yard in one step. How far will he trav by taking 472 steps?

A fraction by a fraction

Illustrations:

I. $\frac{1}{2}$ of $\frac{2}{3}=\frac{1}{3}$

$\frac{1}{2}$ of $\frac{2}{3}=\left\{\begin{array}{l}\text{multiplying the numbers above the line}\\ \text{multiplying the numbers below the line}\end{array}\right\}\frac{2}{6}=\frac{1}{3}$

II. $\frac{3}{4}$ of $\frac{4}{5}=\frac{3}{5}$

$\frac{3}{4}$ of $\frac{4}{5}=\left\{\begin{array}{l}\text{multiplying the numbers above the line}\\ \text{multiplying the numbers below the line}\end{array}\right\}\frac{12}{20}=\frac{3}{5}$

III. $\frac{5}{8}$ times $\frac{7}{12}=\left\{\begin{array}{l}5 \text{ times } 7\\ 8 \text{ times } 12\end{array}\right\}\frac{35}{96}$

IV. $\frac{5}{9}\times\frac{3}{4}=\left\{\begin{array}{c}5\times3\\ 9\times4\end{array}\right\}\frac{15}{36}=\frac{5}{12}$

V. $\frac{7}{11}\times\frac{8}{9}=\left\{\begin{array}{c}7\times8\\ 11\times9\end{array}\right\}\frac{56}{99}$

VI. $\frac{5}{6}$ of $\frac{84}{2}=\frac{420}{12}=35$

VII. $\frac{7}{8}$ times $\frac{4}{5}=\frac{28}{40}=\frac{7}{10}$

Written Exercises

1 $\frac{3}{4}\times\frac{4}{5}=$
2 $\frac{2}{5}\times\frac{5}{8}=$
3 $\frac{7}{10}\times\frac{10}{13}=$
4 $\frac{4}{7}\times\frac{7}{12}=$
5 $\frac{1}{9}\times\frac{18}{23}=$
6 $\frac{10}{13}\times\frac{13}{17}=$
7 $\frac{9}{11}\times\frac{22}{23}=$
8 $\frac{4}{15}\times\frac{18}{19}=$
9 $\frac{2}{9}\times\frac{12}{13}=$
10 $\frac{11}{17}\times\frac{17}{22}=$
11 $\frac{9}{11}\times\frac{33}{12}=$
12 $\frac{7}{25}\times\frac{5}{28}=$
13 $\frac{6}{39}\times\frac{13}{36}=$
14 $\frac{20}{45}\times\frac{15}{60}=$
15 $\frac{13}{48}\times\frac{16}{39}=$
16 $\frac{7}{66}\times\frac{11}{42}=$
17 $\frac{7}{21}\times\frac{12}{18}=$
18 $\frac{28}{78}\times\frac{3}{56}=$
19 $\frac{30}{72}\times\frac{24}{60}=$
20 $\frac{7}{28}\times\frac{9}{4}=$
21 $\frac{7}{16}\times\frac{128}{91}=$
22 $\frac{3}{40}\times\frac{16}{27}=$
23 $\frac{11}{35}\times\frac{5}{33}=$
24 $\frac{21}{69}\times\frac{23}{42}=$
25 $\frac{3}{26}\times\frac{13}{27}=$
26 $\frac{7}{51}\times\frac{17}{28}=$
27 $\frac{13}{44}\times\frac{11}{26}=$
28 $\frac{3}{78}\times\frac{13}{51}=$
29 $\frac{31}{92}\times\frac{23}{62}=$
30 $\frac{17}{38}\times\frac{19}{34}=$

Find the cost of:

31 $\frac{7}{8}$ yd. cloth at \$$\frac{4}{5}$ a yd.
32 $\frac{3}{10}$ *gal. oil at* \$$\frac{3}{4}$ a gal.
33 $\frac{4}{7}$ *lb. coffee at* \$$\frac{7}{10}$ a lb.

34 $\frac{3}{4}$ doz. oranges at \$$\frac{7}{25}$ a doz.

35 $\frac{11}{16}$ lb. butter at \$$\frac{13}{50}$ a lb.

36 A man owns $\frac{7}{11}$ of a farm and sells $\frac{13}{14}$ of what he owns. What part of the farm does he sell?

37 I paid \$$\frac{7}{12}$ a ft. for land and my brother paid $\frac{9}{11}$ as much. How much did my brother pay per foot?

38 A man can do $\frac{5}{8}$ of a piece of work in one day. What part of the work can he do in $\frac{11}{24}$ of a day?

39 In picking over $\frac{7}{13}$ of a barrel of apples, $\frac{13}{35}$ of them was thrown away. What part of the barrel was thrown away?

40 I drew out $\frac{17}{21}$ of my balance in a bank and used $\frac{7}{9}$ of it in paying bills. What part of my balance did I use in paying bills?

An integer by a mixed number

Illustrations:

I. To multiply 148 by $5\frac{1}{2}$

```
                       148
                        5½
                       ———
Multiplying by 5       740
½ of 148 = 74           74
                       ———
                       814, Ans.
```

II. To multiply 815 by $14\frac{2}{3}$

```
                       815
                       14⅔
                      ————
                      3260
                      815
                     —————
                     11410
⅔ of 815 = 543⅓        543⅓
                     —————
                     11953⅓, Ans.
```

Written Exercises

1 $8 \times 18\frac{3}{4} =$
2 $6 \times 14\frac{1}{3} =$
3 $9 \times 42\frac{5}{9} =$
4 $3 \times 31\frac{1}{5} =$
5 $5 \times 17\frac{1}{2} =$
6 $4 \times 53\frac{5}{8} =$
7 $10 \times 16\frac{2}{3} =$
8 $7 \times 37\frac{1}{2} =$
9 $14 \times 66\frac{2}{3} =$
10 $11 \times 12\frac{1}{3} =$
11 $43 \times 11\frac{1}{9} =$
12 $271 \times 6\frac{1}{4} =$
13 $32 \times 22\frac{11}{16} =$
14 $13 \times 19\frac{8}{9} =$
15 $19 \times 11\frac{4}{5} =$
16 $26 \times 187\frac{11}{13} =$
17 $21 \times 47\frac{5}{7} =$
18 $40 \times 29\frac{7}{16} =$
19 $54 \times 13\frac{3}{7} =$
20 $16 \times 91\frac{1}{4} =$
21 $230 \times 16\frac{1}{6} =$
22 $37 \times 21\frac{11}{16} =$
23 $41 \times 17\frac{1}{2} =$
24 $17 \times 39\frac{5}{9} =$
25 $29 \times 14\frac{4}{7} =$
26 $47 \times 23\frac{5}{8} =$
27 $61 \times 110\frac{2}{3} =$
28 43 × 401[illegible] =
29 73 × 220[illegible] =
30 79 × 500[illegible] =

31 At 12 cents a yard, what is the cost of $14\frac{3}{8}$ yd. of cloth?

32 At $7 a ton what will be the cost of $16\frac{1}{4}$ tons of coal?

33 Find the cost of $54\frac{3}{8}$ bu. of wheat at 90 cents a bushel.

34 A man works 7 hours a day for $18\frac{2}{3}$ days. How many hours does he work?

35 How many cubic inches in $14\frac{5}{7}$ gallons?

36 How many ounces in $125\frac{7}{8}$ lb. (Av.)?

37 At 15 cents an hour, how much will a boy earn in $18\frac{2}{3}$ hours?

38 At 84 cents a dozen what will be the cost of $13\frac{7}{12}$ doz. pencils?

39 How many feet are there in $7\frac{3}{8}$ miles?

40 How many miles does a horse travel in $13\frac{4}{5}$ hours at the rate of 6 miles an hour?

A mixed number by a mixed number

Under Reduction—Common Fractions see "mixed numbers to improper fractions."

Under Multiplication—Common Fractions see "A fraction by a fraction."

Illustrations:

I. To multiply $2\frac{1}{2}$ by $7\frac{1}{3}$.

Changed to improper fractions, $2\frac{1}{2} \times 7\frac{1}{3} = \frac{5}{2} \times \frac{22}{3}$

Multiplying $\frac{5}{2} \times \frac{22}{3} = \frac{110}{6} = 18\frac{1}{3}$, Ans.

II. To multiply $20\frac{1}{5}$ by $7\frac{5}{8}$.

Changed to improper fractions, $20\frac{1}{5} \times 7\frac{5}{8} = \frac{101}{5} \times \frac{61}{8}$

Multiplying $\frac{101}{5} \times \frac{61}{8} = \frac{6161}{40} = 154\frac{1}{40}$, Ans.

Written Exercises

1 $3\frac{1}{2} \times 2\frac{2}{3} =$
2 $7\frac{3}{8} \times 5\frac{1}{3} =$
3 $2\frac{2}{3} \times 4\frac{2}{5} =$
4 $9\frac{4}{5} \times 3\frac{1}{9} =$
5 $5\frac{6}{11} \times 9\frac{1}{8} =$
6 $11\frac{3}{4} \times 7\frac{3}{7} =$
7 $17\frac{1}{2} \times 6\frac{2}{9} =$
8 $14\frac{3}{7} \times 1\frac{1}{2} =$
9 $12\frac{5}{6} \times 8\frac{3}{4} =$
10 $20\frac{1}{3} \times 10\frac{5}{6} =$
11 $29\frac{7}{10} \times 12\frac{1}{2} =$
12 $23\frac{1}{6} \times 17\frac{2}{5} =$
13 $16\frac{2}{5} \times 21\frac{7}{8} =$
14 $18\frac{2}{7} \times 14\frac{2}{3} =$
15 $21\frac{6}{7} \times 11\frac{2}{3} =$
16 $40\frac{1}{5} \times 5\frac{1}{4} =$
17 $33\frac{1}{3} \times 12\frac{3}{7} =$
18 $27\frac{7}{9} \times 16\frac{3}{4} =$
19 $32\frac{3}{5} \times 21\frac{1}{8} =$
20 $45\frac{8}{9} \times 6\frac{3}{8} =$
21 $25\frac{2}{9} \times 18\frac{4}{7} =$
22 $19\frac{1}{11} \times 11\frac{4}{5} =$
23 $13\frac{7}{8} \times 7\frac{2}{7} =$
24 $26\frac{5}{9} \times 13\frac{1}{6} =$
25 $44\frac{1}{7} \times 20\frac{7}{8} =$
26 $48\frac{5}{3} \times 34\frac{5}{8} =$
27 $36\frac{1}{9} \times 13\frac{1}{8} =$
28 $54\frac{1}{4} \times 15\frac{3}{5} =$
29 $63\frac{5}{7} \times 32\frac{6}{7} =$
30 $39\frac{4}{5} \times 22\frac{5}{6} =$

Find the cost of:

31 $6\frac{2}{3}$ yards of cloth at $87\frac{1}{2}$ cents a yard.

32 $22\frac{1}{2}$ pounds of sugar at $6\frac{1}{4}$ cents a pound.

33 $18\frac{4}{5}$ tons of coal at \$$7\frac{3}{8}$ a ton.

34 How much will a cubic foot of gold weigh if gold is $19\frac{1}{2}$ times as heavy as water?

35 If a ship sails $17\frac{5}{8}$ miles an hour, how far will it sail in $14\frac{2}{3}$ hours?

36 A wheel travels $14\frac{3}{5}$ feet in making one revolution. How far will it travel in making $37\frac{5}{8}$ revolutions?

37 A family uses $7\frac{2}{3}$ pounds of coffee in a month and $5\frac{1}{4}$ times as much sugar. How much sugar is consumed?

38 A man sold $12\frac{1}{2}$ tons of hay at \$$16\frac{9}{20}$ a ton. How much did he receive for it?

39 A and B start from the same place and walk in opposite directions, A going $3\frac{1}{2}$ miles and B, $4\frac{2}{3}$ miles an hour. How far apart are they at the end of $10\frac{2}{5}$ hours?

40 A merchant buys goods for \$$412\frac{7}{8}$ and sells them for $2\frac{1}{10}$ times as much. How much does he receive for them?

Cancellation

Problems in multiplication of fractions may often be made shorter by cancellation. Cancellation consists in dividing a number above the lines and a number below the lines by the same number and repeating the operation so long as any number above the lines and any number below the lines are divisible by the same number.

Illustrations:

I. To multiply $\frac{12}{25}$ by $\frac{5}{16}$

Dividing by 5
Dividing by 4
Multiplying

$$\frac{\overset{3}{\cancel{12}}}{\underset{5}{\cancel{25}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{4}{\cancel{16}}} = \frac{3}{20}, \text{ Ans.}$$

II. To multiply $\frac{63}{125}$ by $\frac{75}{120}$

Dividing by 25
Dividing by 3
Multiplying

$$\frac{\overset{21}{\cancel{63}}}{\underset{5}{\cancel{125}}} \times \frac{\overset{3}{\cancel{75}}}{\underset{40}{\cancel{120}}} = \frac{63}{200}, \text{ Ans.}$$

Written Exercises

1 $\frac{2}{3}\times\frac{5}{6}=$

2 $\frac{8}{9}\times\frac{3}{4}=$

3 $\frac{1}{3}\times\frac{6}{7}\times\frac{14}{2}=$

4 $\frac{11}{12}\times\frac{4}{33}\times\frac{3}{8}=$

5 $\frac{5}{8}\times\frac{9}{10}\times\frac{3}{5}\times\frac{1}{2}=$

6 $\frac{9}{14}\times\frac{28}{39}\times\frac{13}{14}\times\frac{7}{8}=$

7 $\frac{2}{11}\times\frac{22}{35}\times\frac{14}{15}\times\frac{10}{13}=$

8 $\frac{5}{2}\times\frac{8}{25}\times\frac{10}{7}\times\frac{5}{16}=$

9 $\frac{25}{12}\times\frac{14}{5}\times\frac{16}{21}\times\frac{15}{8}=$

10 $\frac{7}{3}\times\frac{17}{28}\times\frac{15}{34}\times\frac{8}{25}=$

11 $\frac{36}{31}\times\frac{1}{9}\times\frac{35}{48}\times\frac{68}{70}=$

12 $\frac{13}{17}\times\frac{15}{26}\times\frac{34}{45}\times\frac{3}{4}=$

13 $\frac{3}{8}\times\frac{5}{32}\times\frac{8}{63}\times\frac{9}{25}=$

14 $\frac{16}{9}\times\frac{47}{14}\times\frac{6}{13}\times\frac{9}{16}=$

15 $\frac{65}{17}\times\frac{70}{14}\times\frac{39}{14}\times\frac{68}{13}=$

16 $\frac{42}{64}\times\frac{9}{28}\times\frac{33}{19}\times\frac{14}{11}=$

17 $\frac{8}{5}\times\frac{24}{39}\times\frac{25}{27}\times\frac{18}{16}=$

18 $\frac{6}{11}\times\frac{9}{22}\times\frac{5}{24}\times\frac{121}{144}=$

19 $\frac{14}{23}\times\frac{69}{72}\times\frac{4}{9}\times\frac{54}{63}=$

20 $\frac{39}{40}\times\frac{16}{37}\times\frac{87}{91}\times\frac{15}{29}=$

21 $\frac{12}{49}\times\frac{8}{57}\times\frac{19}{27}\times\frac{7}{40}=$

22 $\frac{51}{52}\times\frac{20}{21}\times\frac{9}{16}\times\frac{4}{7}=$

23 $\frac{19}{20}\times\frac{24}{25}\times\frac{21}{22}\times\frac{33}{38}=$

24 $\frac{15}{32}\times\frac{16}{23}\times\frac{22}{39}\times\frac{46}{55}=$

25 $\frac{9}{16}\times 14\times\frac{8}{15}\times\frac{4}{21}=$

26 $\frac{32}{33}\times\frac{7}{24}\times 11\times\frac{27}{28}=$

27 $7\times\frac{12}{13}\times\frac{39}{53}\times\frac{9}{16}=$

28 $9\times\frac{14}{15}\times\frac{50}{63}\times 4\frac{1}{2}=$

29 $\frac{8}{19}\times\frac{11}{18}\times 7\frac{3}{5}\times 12=$

30 $\frac{93}{100}\times 6\frac{7}{8}\times\frac{8}{11}\times\frac{80}{31}=$

31 $\frac{6}{25}\times\frac{65}{72}\times\frac{8}{39}\times 15=$

32 $18\frac{1}{5}\times\frac{6}{13}\times\frac{15}{28}\times 4\frac{4}{5}=$

33 $\frac{1}{4}\times 22\times\frac{6}{13}\times\frac{39}{44}=$

34 $\frac{28}{70}\times\frac{7}{69}\times 11\frac{1}{2}\times\frac{5}{46}=$

35 $\frac{7}{16}\times 18\times\frac{32}{63}\times\frac{35}{91}=$

36 $\frac{19}{36}\times 6\frac{1}{3}\times 5\frac{5}{8}\times\frac{35}{38}=$

37 $10\frac{3}{7}\times\frac{11}{18}\times 27\times\frac{72}{73}=$

38 $7\frac{2}{9}\times\frac{4}{5}\times\frac{10}{13}\times 30=$

39 $\frac{76}{51}\times\frac{17}{35}\times\frac{14}{19}\times\frac{15}{22}=$

40 $12\frac{1}{2}\times 21\times\frac{8}{20}\times\frac{27}{35}=$

MULTIPLICATION—COMPOUND NUMBERS

Illustrations:

I. To multiply 4 sq. yd., 8 sq. ft., 100 sq. in. by 6

	4 sq. yd.	8 sq. ft.	100 sq. in.
	×6		
600 sq. in. is more than 1 sq. ft.	24 sq. yd.	48 sq. ft.	~~600~~ sq. in.
600 sq. in. = 4 sq. ft., 24 sq. in.			
Adding 4 sq. ft., 24 sq. in. to		4 sq. ft.	24 sq. in.
24 sq. yd., 48 sq. ft.	24 sq. yd.	~~52~~ sq. ft.	24 sq. in.
24 sq. in. is less than 1 sq. ft.			
52 sq. ft. is more than 1 sq. yd.			
52 sq. ft. = 5 sq. yd., 7 sq. ft.			
Adding 5 sq. yd., 7 sq. ft. to	5 sq. yd.	7 sq. ft.	
24 sq. yd., 24 sq. in.	29 sq. yds.	7 sq. ft.	24 sq. in. Ans.

II. To find 41 times 40 rd., 4 yd. 2 ft. 7 in.

		40 rd.	4 yd.	2 ft.	7 in.
		×41			
		1640 rd.	164 yd.	82 ft.	~~287~~ in.
287 in. = 23 ft. 11 in.				23 ft.	11 in.
		1640 rd.	164 yd.	~~105~~ ft.	11 in.
105 ft. = 35 yd.			35 yd.		
		1640 rd.	~~199~~ yd.		11 in.
199 yd. = 36 rd. 1 yd.		36 rd.	1 yd.		
		~~1676~~ rd.	1 yd.		11 in.
1676 rd. = 5 mi. 76 rd.	5 mi.	76 rd.			
	5 mi.	76 rd.	1 yd.		11 in. Ans.

Written Exercises

1 Multiply 3 bu. 2 pk. 7 qt. 1 pt. by 6.

2 Multiply 130 rd. 5 yd. 2 ft. 10 in. by 15

3 Multiply 8 gal. 3 qt. 1 pt. 2 gi. by 4.

4 Multiply 7 ton 4 cwt. 80 lb. 10 oz. by 5.

5 Multiply 2 cd. 10 cu. ft. 20 cu. in. by 10

6 *Multiply* 2 wk. 3 da. 5 hr. 30 min. 50 sec. by 8.

7 Multiply 1 A. 6 sq. rd. 20 sq. yd. 5 sq. ft. by 3.

8 Multiply 5 mi. 30 rd. 3 yd. 1 ft. 3 in. by 17.

9 Multiply 4 hhd. 40 gal. 2 qt. 3 gi. by 6.

10 Multiply 10 bu. 1 pk. 1 qt. 1 pt. by 40.

11 What was the total weight of 14 loads of hay, the loads averaging 1 ton 4 cwt. 60 lb.?

12 Find the total distance covered in 6 days by a ship sailing 196 mi. 140 rd. 3 yd. 1 ft. per day.

13 A field is divided into 12 lots, each containing 1 A. 12 sq. rd. 10 sq. yd. 5 sq. ft. 10 sq. in. What is their combined area?

14 136 barrels of wine averaged 31 gal. 2 qt. 1 pt. 3 gi. How much wine was there in the whole quantity?

15 If the daily runs of an engineer average 105 mi. 100 rd. 2 yd. 1 ft. 6 in., how far does he run in a week of six days?

16 How much wood can 30 wood-choppers cut in 3 days at the rate of 2 cd. 10 cu. ft. per day?

17 If a wheel advances 4 ft. 7 in. at each revolution, how far does it travel in 1200 revolutions?

18 What is the total amount of coal in three trains, each train consisting of 23 cars, each car containing 11 T. 6 cwt. 50 lb. of coal?

19 Find the total product of 10 acres of land, each acre producing 163 bu. 2 pk. 5 qt. of potatoes.

20 Two trains start from the same place, going in opposite directions, one at the rate of 30 mi. 40 rd. 5 yd. 2 ft. per hour and the other, 18 mi. 130 rd. 3 yd. 1 ft. 6 in. per hour. How far apart will they be in 8½ hours?

DIVISION—INTEGERS

The result of a division is called the **quotient.**

Illustrations:

I. To divide 38427 by 3

$$\begin{array}{r} 3\overline{)38427} \\ 12809 \end{array} = \text{quotient, Ans.}$$

Steps: 3 is contained in 3, one time and none over.
3 is contained in 8, two times and two over.
3 is contained in 24, eight times and none over.
3 is contained in 2, no times.
3 is contained in 27, nine times, none over.

This method is called short division. Use short division when dividing by a number of one digit.

II. To divide 48762 by 18

Steps: 18 is contained in 4, no times.
18 is contained in 48, two times.
2 times 18 = 36. 36 from 48 = 12.
Bring down the next figure, 7.
18 is contained in 127, 7 times.
7 times 18 = 126. 126 from 127 = 1.
Bring down the next figure, 6.
18 is contained in 16, no times.
Bring down the next figure 2.
18 is contained 162, 9 times.

9 times 18 = 162. 162 from 162 = 0.

$$\begin{array}{r} 2709\text{, Ans.} \\ 18\overline{)48762} \\ \underline{36} \\ 127 \\ \underline{126} \\ 162 \\ \underline{162} \end{array}$$

III. To divide 4639 by 26

26 is contained in 4639 an uneven number of times. There is a remainder of 11. 26 is contained in 11, $\frac{11}{26}$ times. Place the number by which we divide beneath the remainder and write the fraction thus formed (in its lowest terms) as a part of the quotient If the remainder exceeds the number by *which we divide*, our work is incorrect.

$$\begin{array}{r} 178\frac{11}{26}\text{, Ans} \\ 26\overline{)4639} \\ \underline{26} \\ 203 \\ \underline{182} \\ 219 \\ \underline{208} \\ \frac{11}{26} \end{array}$$

IV. (a) To divide 85672 by 985

It is not easy to determine how many times 985 is contained in 8567 by looking at the two numbers as a whole. Think of 985 as being 9 hundred and of 8567 as being 80 hundred, 9 hundred is contained in 80 hundred 8 times.

$$\begin{array}{r l} & \underline{86\tfrac{962}{985}}\text{, Ans.} \\ 985)\!\!\!\! & 85672 \\ & \underline{7880} \\ & 6872 \\ & \underline{5910} \\ & \underline{962} \\ & 985 \end{array}$$

(b) To divide 98893 by 4272

It is not easy to determine how many times 4272 is contained in 9889 by looking at the two numbers as a whole. Think of 4272 as being 4 thousand and of 9889 as being 9 thousand; 4 thousand is contained in 9 thousand, two times.

$$\begin{array}{r l} & \underline{23\tfrac{637}{4272}}\text{, Ans.} \\ 4272)\!\!\!\! & 98893 \\ & \underline{8544} \\ & 13453 \\ & \underline{12816} \\ & \underline{637} \\ & 4272 \end{array}$$

Think of 13453 as being 13 thousand, 4 thousand is contained in 13 thousand, three times.

This method helps to determine what the quotient is to be.

To divide by 10, 100, 1000, etc.

Illustrations:

I. To divide 3568 by 10, by 100, and by 1000.

356.8, Ans.	35.68, Ans.	3.568, Ans.
10)3568.0	100)3568.00	1000)3568.000
30	300	3000
56	568	5680
50	500	5000
68	680	6800
60	600	6000
80	800	8000
80	800	8000

Observe that in dividing by 10 the decimal point is moved **one** place to the left; that in dividing by 100, the decimal point is moved **two** places to the left; that in dividing by 1000, the decimal point is moved **three** places to the left.

5427 ÷ 100 = 54.27
3985 ÷ 1000 = 3.985.

Written Exercises

1 9765÷3.

2 18657÷9.

3 85407÷7.

4 There are eight quarts in a peck How many pecks are there in 744 quarts?

5 Divide 97640 by 20.

6 Divide 18650 by 25.

7 Divide 53253 by 61.

8 Divide 143208 by 78.

9 Divide 122000 by 125.

10 Divide 911144 by 8761.

11 Divide 238840 by 140.

12 Divide 47873 by 6839.

13 Divide 6544126 by 829.

14 Divide 4931052 by 8743.

15 Divide 9465084 by 978.

16 When 979 acres of land produce 95942 bu. of potatoes, what is the average yield per acre?

17 How many acres of land at $378 per acre, can be bought for $3692304?

18 What is the value of each lot, when 256 lots of land are sold for $121600?

19 20000 bu. of wheat were shipped in 34 carloads; what was the average per car?

20 During a certain month 674178 pounds of flour was put into barrels, each containing 196 lb. How many barrels were used?

21 If a tank holds 3764 gallons, how many times can it be filled from a reservoir holding 1000000 gal.?

22 How many regiments of 874 men each, can be made out of 24172 men, and how many men will be left over?

23 How many bales of cotton, each weighing 480 lb. can be made of 876473 lb.?

24 When oil is 13 cents per gallon, how many gallons can be bought for 976143 cents?

25 At $65 per acre, how many acres of land can be bought for $365714?

DIVISION—DECIMALS

The process of division of decimals does not differ from the process of division of integers, except in the handling of the decimal point, and this is all-important.

Illustrations:

I. To divide 1728 by 3.6

$$3.6)1728.$$

$$\begin{array}{r@{}l} & 480,\text{ Ans.}\\ 36) & \overline{17280}\\ & \underline{144}\\ & 288\\ & \underline{288}\end{array}$$

Multiplying both 3.6 and 1728. by the same number will not change the value of the quotient. Multiplying by the number that will make the number by which we divide a whole number,—that is, multiplying by 10, we have 17280 divided by 36, two integers.

II. To divide 14.4 by 12

$$\begin{array}{r@{}l} & 1.2,\text{ Ans.}\\ 12) & \overline{14.4}\\ & \underline{12}\\ & 24\\ & \underline{24}\end{array}$$

Observe that the number by which we divide is a whole number. We know that 12 is contained in 14 much less than 12 times, much more than .12 of a time, a little more than 1 time. We know that our quotient is 1.2.

Observe that the decimal point in quotient comes directly over the decimal point in the number divided.

Observe that there is the same number of decimal places in both the number divided, and the quotient. This is always the case when we divide by a whole number.

III. To divide 12.832 by .16

$$.16)12.832$$

$$\begin{array}{r@{}l} & 80.2,\text{ Ans.}\\ 16.) & \overline{1283.2}\\ & \underline{128}\\ & 32\\ & \underline{32}\end{array}$$

As in Illustration I, we multiply both numbers by that which will make the number by which we divide an integer. Multiplying by 100, we have 1283.2 divided by *16. which* does not differ in form from *Illustration II.*

IV. To divide .8241 by .026.

Step:
1 Multiplying by 1000
2 Dividing as in integers
3 Placing point in quotient over point in number divided.

```
     31.6 25/26, Ans.
.026.).824.1
       78
        44
        26
        181
        156
         25 remainder = 25/26
```

Observe that there is a remainder (25). Ciphers may be added at the right of the decimal in the number divided, and the division carried on indefinitely, or until there is no remainder.

```
       31.69615384, Ans.
.026)824.10000000
     78
      44
      26
      181
      156
       250
       234
        160
        156
          40
          26
          140
          130
           100
            78
           220
           208
            120
            104
             16
```

Observe that this division could be continued indefinitely, since we have secured the same remainder a second time.

It is customary to carry such quotients to decimals of four places, disregarding what might follow, were the division continued; many problems, however, indicate how far the decimal is to be carried.

Written Exercises

1 Divide 436.15 by 65.
2 Divide 4.3056 by .069.
3 Divide .083927 by 8.9.
4 Divide 46368 by .0072.
5 Divide 253.800 by 4.7.
6 Divide 635.2 by .0794.
7 Divide 61.074 by .0078.
8 Divide 190.28 by .067.

9 Divide 131.25 by 1.5.
10 Divide 29.565 by 9125.
11 Divide 208.8 by .087.
12 Divide 564.44 by .206.
13 Divide 1.97316 by .972.
14 Divide .0072 by 96.
15 Divide .00175 by .075.
16 Divide 4.176 by 1.3342.
17 Divide 1.00176 by 145.
18 Divide 4.040404 by 1.73.
19 Divide .0003 by 736.
20 Divide 976.54 by .357.

21 How long will it take a train going at the rate of 29.6 miles per hour to travel 508.084 miles?

22 At the rate of 31.76 rods per day, how many days will it take to build 1524.48 rods?

23 If a train travels 448.2 miles in 8.64 hours, what is its rate per hour?

24 If a farm of 31.25 acres produces 2075 bushels of potatoes what was the average yield per acre?

25 Two vessels sail from the same point in opposite directions, one at the rate of 21.173 miles per hour, and the other at the rate of 11.476 miles per hour. In how many hours will they be 510 miles apart?

26 A field containing 4752 square rods, is 84.48 rods long. What is the width of the field?

27 If a car holds 11.875 tons of coal, how many cars would be needed to carry 430.46875 tons?

28 At the rate of 24.25 miles per day, how many days will be required for a man to walk 261.9 miles?

29 If a wheel advances 10.075 feet in one revolution, how many revolutions will it make in going 363.7075 feet?

30 A farm 82.56 rods long contains 1418.288 square rods. What is its width?

To change a decimal to the nearest tenths, hundredths, thousandths, etc.

(a)	(b)	(c)
.8	.81	815
.81	.811	.8151
.82	.812	.8152
.83	.813	.8153
.84	.814	.8154
.85	.815	.8155
.86	.816	.8156
.87	.817	.8157
.88	.818	.8158
.89	.819	8159
.9	.82	816

I. To change .81 to the nearest tenths. (See Number Reading, page 14.)

Tenths require one decimal place.
.85 is just as near .8 as .9.
.81 is nearer .8 than .9, therefore,
.81 to nearest tenths = .8, Ans.

II. To change .815 to the nearest hundredths.

Hundredths require two decimal places.
.815 is just as near .81 as .82.
In such a case the higher number is used, therefore
.815 to the nearest hundredths = .82, Ans.

III. To change .8158 to the nearest thousandths.

Thousandths require three decimal places.
.8155 is just as near .815 as .816.
.8158 is nearer .816 than .815, therefore,
.8158 to the nearest thousandths = .816, Ans.

Observe that when the last digit to be used is followed by a figure as large as 5 or larger, that digit is increased by 1; when the last digit to be used is followed by a figure smaller than 5, that digit remains the same.

Illustration:

Change to nearest hundredths:

.78	
.781	.78
.782	.78
.783	.78
.784	.78
.785	.79
.786	.79
.787	.79
.788	.79
.789	.79
.79	

DIVISION—UNITED STATES MONEY

This is an application of division of decimals. Divide as in decimals.

Illustrations:

I. To divide $450.65 by 18.

```
          $ 25.0361, Ans.
     18.)$450.6500
          36
           90
           90
            065
             54
             110
             108
               20
               18
                2
```

II. To divide $482.63 by $4.35.

```
              110.9494 times, Ans.
     $4.35.)$482.63.0000
              435
               476
               435
                4130
                3915
                 2150
                 1740
                  4100
                  3915
                   1850
                   1740
                    110
```

Written Exercises

1 Divide $44.25 by $0.25.
2 Divide $4,003.75 by $1.25.
3 Divide $103.92 by 48.
4 *Divide $2,447.60* by 56.

5 How many bushels of potatoes at 75 cents a bushel can be bought for $365.75?

6 How many pounds of lard at 9 cents 5 mills a pound can be bought for $31.065?

7 At $43.75 per acre, how many acres of land can be bought for $2,187.50?

8 At 11 cents 5 mills per gallon, how much oil can be bought for $41.6875?

9 At $6.75 per ton, how much coal can be bought for $2,814.75?

10 At the rate of $0.625 each, the cost of maintaining a company of soldiers was $75.00. How many were in the company?

11 At $0.025 per foot, how many thousand feet of lumber can be bought for $35.375?

12 At $0.80 each, how many dozen base balls can be bought for $216.00?

13 When 156 horses are bought for $13,611.00, what is the price of each?

14 There are 31.5 gallons in a barrel. How many barrels are there in 9,763.45 gallons?

15 At $0.037 per yard, how much cloth can be bought for $135.05?

16 At 4 cents 5 mills per quart, how many quarts of berries can be bought for $16.025?

17 At $0.025 per mile, how many miles can one travel for $687.50?

18 At $3.85 per half ton, how many tons of coal can be bought for $281.8585?

19 How many suits, worth $31.50 each, can be bought for $2,756.25 and how much money will be left over?

20 How many ties at $0.375 can be bought for $135.00?

DIVISION—COMMON FRACTIONS

An integer divided by a fraction

Illustrations:

I. To divide 6 by $\frac{1}{4}$.

Multiply both numbers by the term below the line. $\frac{1}{4})\overline{6}$

4 times $\frac{1}{4}=\frac{4}{4}$ or 1.

4 times $6=24$.

(Observe that both numbers are integers) $1)\underline{24}$

24, Ans.

Or: by inverting the number by which we divide:

$6\div\frac{1}{4}=6\times\frac{4}{1}=24$, Ans

II. To find how many times $\frac{7}{8}$ is contained in 18.

Multiply both numbers by the term below the line. $\frac{7}{8})\overline{18}$

8 times $\frac{7}{8}=\frac{56}{8}=7$. $7)\underline{144}$

8 times $18=144$. $20\frac{4}{7}$, Ans

(Observe that both numbers are now integers.)

Or: by inverting the number by which we divide·

$18\div\frac{7}{8}=18\times\frac{8}{7}=\frac{144}{7}=20\frac{4}{7}$, Ans.

Written Exercises

1 Divide 4 by $\frac{1}{4}$.
2 Divide 12 by $\frac{2}{3}$.
3 Divide 8 by $\frac{3}{5}$.
4 Divide 11 by $\frac{2}{7}$.
5 Divide 14 by $\frac{5}{6}$.
6 Divide 20 by $\frac{11}{12}$.
7 Divide 16 by $\frac{7}{8}$.
8 Divide 22 by $\frac{9}{10}$.
9 Divide 35 by $\frac{5}{7}$.
10 Divide 29 by $\frac{3}{8}$.
11 Divide 21 by $\frac{7}{10}$.
12 Divide 34 by $\frac{13}{16}$.
13 Divide 24 by $\frac{14}{15}$.
14 Divide 18 by $\frac{11}{20}$.
15 Divide 43 by $\frac{13}{16}$

Find the value of

16 $12\div\frac{7}{13}$.
17 $9\div\frac{5}{81}$.
18 $16\div\frac{15}{16}$.
19 $15\div\frac{13}{14}$.
20 $5\div\frac{12}{17}$.
21 $18\div\frac{7}{11}$.
22 $20\div\frac{4}{15}$.
23 $18\div\frac{7}{14}$.
24 $17\div\frac{4}{13}$.
25 $32\div\frac{5}{9}$.
26 $30\div\frac{6}{7}$.
27 $48\div\frac{9}{11}$.
28 $27\div\frac{13}{33}$.
29 $36\div\frac{18}{23}$.
30 $52\div\frac{13}{17}$.

31 *How many* yards of cloth at $\$\frac{2}{3}$ a yard can be bought for *\$15.00?*

32 How many steps $\frac{3}{4}$ of a yard long would it take to travel 25 yards?

33 At $\$\frac{3}{10}$ a dozen, how many dozen oranges can be bought for $11.00?

34 How many packages weighing $\frac{7}{11}$ of a pound each, would it take to make up a case weighing 140 lb.?

35 How many letters averaging $\frac{7}{16}$ of an ounce each, are there in a mail consisting entirely of letters and weighing 189 ounces?

36 How far can a man go in 17 hours at the rate of a mile in $\frac{4}{13}$ of an hour?

37 I paid $21.00 for peaches at $\$\frac{7}{8}$ a basket. How many baskets did I buy?

38 In 12 acres of land, how many lots are there containing $\frac{4}{9}$ of an acre each?

39 How many garments can be made from 12 yards of cloth if each garment requires $\frac{4}{15}$ of a yard?

40 Butter is $\$\frac{2}{11}$ a pound. How many lb. can be bought for $24.00?

An integer by a mixed number

Illustrations:

I. To divide 85 by $4\frac{1}{3}$.

Multiply both numbers by the term below the line.

3 times $4\frac{1}{3} = 13$.

3 times $85 = 255$.

(Observe that both numbers are now integers.)

$$\begin{array}{r l} 4\frac{1}{3})85 & \\ \underline{19\frac{8}{13}}, & \text{Ans.} \\ 13)255 & \\ \underline{13} & \\ 125 & \\ \underline{117} & \\ 8\frac{8}{13} & \end{array}$$

Or: by inverting the number by which we divide:

$$85 \div 4\frac{1}{3} = 85 \div \frac{13}{3} = 85 \times \frac{3}{13} = \frac{255}{13} = 19\frac{8}{13}, \text{ Ans.}$$

Written Exercises

1	Divide 17 by $3\frac{1}{2}$.	11	$16 \div 3\frac{1}{5}$.	21	$47 \div 15\frac{2}{3}$.
2	Divide 6 by $1\frac{15}{16}$.	12	$45 \div 1\frac{2}{15}$.	22	$112 \div 9\frac{8}{10}$
3	Divide 91 by $4\frac{1}{6}$.	13	$92 \div 8\frac{3}{4}$.	23	$73 \div 11\frac{7}{8}$.
4	Divide 45 by $8\frac{3}{4}$.	14	$145 \div 20\frac{5}{7}$.	24	$49 \div 14\frac{3}{7}$.
5	Divide 59 by $1\frac{5}{6}$.	15	$80 \div 12\frac{5}{8}$.	25	$64 \div 10\frac{2}{3}$.
6	Divide 40 by $3\frac{2}{5}$.	16	$236 \div 16\frac{1}{8}$.	26	$94 \div 17\frac{7}{12}$.
7	Divide 140 by $6\frac{2}{3}$.	17	$56 \div 1\frac{8}{9}$.	27	$213 \div 23\frac{5}{8}$.
8	Divide 24 by $2\frac{11}{12}$.	18	$124 \div 12\frac{3}{4}$.	28	$371 \div 74\frac{2}{5}$.
9	*Divide 10 by* $9\frac{3}{5}$.	19	$131 \div 3\frac{2}{5}$.	29	$193 \div 42\frac{3}{15}$.
10	*Divide 63 by* $24\frac{2}{3}$.	20	$96 \div 5\frac{1}{2}$.	30	$872 \div 91\frac{9}{11}$.

31 How many cord feet of wood can be bought for \$17.00 at \$$1\frac{1}{2}$ a cord foot?

32 At \$$3\frac{1}{4}$ each, how many pairs of shoes can be bought for \$39.00?

33 How many tons of coal can be bought for \$81.00 at \$$7\frac{3}{8}$ a ton?

34 A man can row $3\frac{2}{11}$ miles an hour. How long will it take him to row 21 miles?

35 A case of goods weighs $3\frac{4}{7}$ hundredweight. How many similar cases will it take to weigh 125 hundredweight?

36 How long will it take a train going at the rate of $32\frac{9}{13}$ miles an hour to travel 220 miles?

37 I paid \$$4\frac{1}{17}$ a barrel for a certain number of barrels of apples, paying in all \$130.00. How many barrels did I buy?

38 What is the price of wood when $6\frac{7}{8}$ cords cost \$36.00?

39 How many steps of $2\frac{7}{12}$ feet each will be required in walking a mile?

40 A man divided \$64.00 among a certain number of children, giving \$$3\frac{1}{5}$ to each. How many children were there?

A fraction by an integer

Illustrations:

I. To divide $\frac{3}{5}$ by 5.

Multiply both numbers by the term below the line.

$5)\frac{3}{5}$

5 times $5 = 25$.

5 times $\frac{3}{5} = \frac{15}{5} = 3$.

$\frac{3}{25}$, Ans.

$25)\overline{3}$

(Observe that both numbers are now integers.)

25 is contained in 3 less than one time, therefore, the quotient is expressed thus, $\frac{3}{25}$, Ans.

Or: inverting the number by which we divide:

$\frac{3}{5} \div 5 = \frac{3}{5} \times \frac{1}{5} = \frac{3}{25}$, Ans.

II. To divide $\frac{23}{27}$ by 92.

Multiply both numbers by the term below the line.

$27 \times \frac{23}{27} = \frac{621}{27} = 23$.

$92 \times 27 = 2{,}484$.

$23 \div 2{,}484 = \frac{23}{2484} = \frac{1}{108}$, Ans.

Or: inverting the number by which we divide:

$$\frac{23}{27} \div 92 = \frac{\overset{1}{\cancel{23}}}{27} \times \frac{1}{\underset{4}{\cancel{92}}} = \frac{1}{108}, \text{ Ans.}$$

Written Exercises

Find the value of

1 Divide $\frac{4}{7}$ by 6.
2 Divide $\frac{5}{8}$ by 3.
3 Divide $\frac{3}{11}$ by 9.
4 Divide $\frac{10}{13}$ by 13.
5 Divide $\frac{4}{9}$ by 4.
6 Divide $\frac{6}{7}$ by 5.
7 Divide $\frac{1}{9}$ by 9.
8 Divide $\frac{10}{19}$ by 6.
9 Divide $\frac{24}{25}$ by 12.
10 Divide $\frac{13}{17}$ by 8.
11 $\frac{45}{49} \div 15.$
12 $\frac{11}{12} \div 12.$
13 $\frac{34}{35} \div 17.$
14 $\frac{7}{15} \div 23.$
15 $\frac{8}{11} \div 32.$
16 $\frac{34}{41} \div 51.$
17 $\frac{2}{3} \div 31.$
18 $\frac{15}{16} \div 25.$
19 $\frac{4}{5} \div 41.$
20 $\frac{30}{31} \div 30.$
21 $\frac{51}{53} \div 17.$
22 $\frac{12}{13} \div 24.$
23 $\frac{1}{8} \div 43.$
24 $\frac{93}{100} \div 62.$
25 $\frac{25}{27} \div 40.$
26 $\frac{15}{22} \div 36.$
27 $\frac{42}{49} \div 28.$
28 $\frac{26}{27} \div 39.$
29 $\frac{41}{50} \div 82.$
30 $\frac{18}{38} \div 27.$

31 If \$$\frac{4}{5}$ is divided equally among 10 children, how much does each receive?

32 At \$4.00 a yard, how much cloth will be bought for \$$\frac{8}{9}$?

33 One dozen pencils weigh $\frac{3}{32}$ of a pound; how much does each pencil weigh?

34 A package of 11 letters weighs $\frac{22}{65}$ of a pound. How much do they average?

35 It takes 528 steps to walk $\frac{1}{4}$ of a mile. How long is each step?

A mixed number by an integer

Illustrations:

I. To divide $4\frac{5}{8}$ by 3.

Multiply both numbers by the term below the line.	$3)4\frac{5}{8}$
8 times 3 = 24.	$1\frac{13}{24}$, Ans.
8 times $4\frac{5}{8}$ = 37.	$24)\overline{37}$
(Observe that both numbers are now integers.)	24
	$13\frac{13}{24}$

Or: inverting the number by which we divide:

$$4\tfrac{5}{8} \div 3 = \tfrac{37}{8} \div 3 = \tfrac{37}{8} \times \tfrac{1}{3} = \tfrac{37}{24} = 1\tfrac{13}{24}, \text{ Ans.}$$

Written Exercises

1 Divide $3\frac{3}{5}$ by 7.
2 Divide $7\frac{1}{3}$ by 4.
3 Divide $4\frac{7}{8}$ by 5.
4 Divide $5\frac{1}{7}$ by 9.
5 Divide $9\frac{2}{3}$ by 6.
6 Divide $6\frac{3}{4}$ by 8.
7 Divide $8\frac{1}{4}$ by 3.
8 Divide $31\frac{2}{9}$ by 12.
9 *Divide* $24\frac{1}{2}$ by 17.
10 *Divide* $17\frac{5}{6}$ by 13.
11 $33\frac{4}{5} \div 21.$
12 $93\frac{1}{6} \div 14.$
13 $54\frac{2}{7} \div 19.$
14 $45\frac{3}{8} \div 15.$
15 $65\frac{3}{5} \div 27.$
16 $82\frac{5}{6} \div 11.$
17 $51\frac{3}{7} \div 23.$
18 $86\frac{2}{5} \div 30.$
19 $59\frac{5}{8} \div 15.$
20 $42\frac{4}{7} \div 18.$
21 $47\frac{1}{2} \div 22.$
22 $310\frac{2}{3} \div 36.$
23 $194\frac{1}{5} \div 45.$
24 $220\frac{2}{11} \div 33.$
25 $156\frac{1}{3} \div 39.$
26 $312\frac{3}{4} \div 48.$
27 $491\frac{3}{4} \div 60.$
28 $1031\frac{1}{5} \div 54.$
29 $460\frac{1}{4} \div 56$
30 $914\frac{3}{5} \div 42.$

31 If \$$18\frac{5}{8}$ are divided equally among 7 persons, how much does each receive?

32 If a line $27\frac{7}{16}$ inches long is divided into 12 equal parts, how long is each part?

33 Find the cost of a yard of cloth when 17 yards cost \$$43\frac{3}{10}$.

34 How long would it take a man to walk $34\frac{2}{5}$ miles at the rate of 5 miles an hour?

35 I paid \$$105\frac{3}{8}$ for 16 cords of wood. What was the price per cord?

36 At \$6.00 a bushel, how many bushels of wheat can be bought for \$$81\frac{1}{4}$?

37 Fifty-four watches cost \$$462\frac{2}{5}$. What is the cost of each?

38 What is the average weight of books, 32 of which weigh $24\frac{1}{3}$ lb.?

39 A train runs at the rate of 32 miles an hour. How long does it take it to travel $214\frac{1}{2}$ miles?

40 Eighteen packages weigh $59\frac{4}{5}$ ounces. What is their average weight?

A fraction by a fraction

Illustrations:

I. To divide $\frac{7}{8}$ by $\frac{5}{9}$.

(a) Multiply both numbers by the least number that will contain the terms below the lines. (See Addition—Common Fractions.)

72 times $\frac{7}{8} = 63$.

72 times $\frac{5}{9} = 40$.

(Observe that both numbers are now integers.)

$$\begin{array}{r} 1\frac{23}{40}\text{, Ans.} \\ 40\overline{)63} \\ \underline{40} \\ 23\frac{23}{40} \end{array}$$

Or: inverting the number by which we divide:

$$\frac{7}{8} \div \frac{5}{9} = \frac{7}{8} \times \frac{9}{5} = \frac{63}{40} = 1\frac{23}{40}\text{, Ans.}$$

(b) $\frac{7}{8} \div \frac{5}{9}$ is the same as $\frac{7}{8} \times \frac{9}{5}$.

(Inverting the fraction by which we divide.)

$\frac{7}{8} \times \frac{9}{5} = \frac{63}{40} = 1\frac{23}{40}$, Ans.

(See Multiplication—Common Fractions.)

II. Simplify the following:

$\frac{3}{4} \times \frac{7}{8}$ of $\frac{4}{5} \div \frac{2}{3}$ of $\frac{5}{9} \times \frac{3}{5}$.

$$\frac{3}{\cancel{4}} \times \frac{7}{8} \times \frac{\cancel{4}}{\cancel{5}} \times \frac{3}{2} \times \frac{9}{5} \times \frac{\cancel{5}}{3} = \frac{189}{80} = 2\frac{29}{80}\text{, Ans.}$$

Written Exercises

1 $\frac{5}{6} \div \frac{2}{3}$.
2 $\frac{4}{5} \div \frac{7}{8}$.
3 $\frac{6}{11} \div \frac{15}{16}$.
4 $\frac{4}{13} \div \frac{9}{10}$.
5 $\frac{8}{9} \div \frac{3}{4}$.
6 $\frac{4}{5} \div \frac{8}{9}$.
7 $\frac{2}{3} \div \frac{7}{11}$.
8 $\frac{15}{16} \div \frac{9}{10}$.
9 $\frac{14}{9} \div \frac{4}{5}$.
10 $\frac{12}{13} \div \frac{7}{8}$.

11 $\frac{5}{2} \div \frac{6}{11}$.
12 $\frac{21}{22} \div \frac{13}{11}$.
13 $\frac{8}{15} \div \frac{7}{5}$.
14 $\frac{24}{25} \div \frac{15}{7}$.
15 $\frac{18}{23} \div \frac{9}{46}$.
16 $\frac{24}{29} \div \frac{6}{58}$.
17 $\frac{3}{11} \div \frac{15}{33}$.
18 $\frac{20}{27} \div \frac{5}{9}$.
19 $\frac{12}{25} \div \frac{24}{25}$.
20 $\frac{16}{19} \div \frac{32}{38}$.

21 $\frac{114}{115} \div \frac{26}{33}$.
22 $\frac{18}{95} \div \frac{4}{213}$.
23 $\frac{27}{301} \div \frac{88}{91}$.
24 $\frac{81}{61} \div \frac{21}{71}$.
·25 $\frac{881}{401} \div \frac{14}{23}$.
26 $\frac{196}{333} \div \frac{21}{83}$.
27 $\frac{629}{364} \div \frac{2}{231}$.
28 $\frac{8}{513} \div \frac{21}{760}$.
29 $\frac{1}{141} \div \frac{1}{342}$.
30 $\frac{1}{1728} \div \frac{1}{144}$.

31 Find the cost of 1 yard cotton cloth when $\frac{5}{8}$ yard costs \$$\frac{5}{8}$.

32 How many yards of cloth can be bought for \$$\frac{7}{8}$ when 1 yard costs \$$\frac{3}{16}$?

33 Divide one-eighth of a dollar by $\frac{5}{6}$.

34 Divide three-fourths of a dollar by \$$\frac{2}{3}$.

35 How many thirds in $\frac{5}{6}$?

A mixed number by a mixed number

Illustrations:

I. To divide $45\frac{5}{8}$ by $17\frac{3}{4}$.

Multiply both numbers by the least number that will contain the term below the lines.

8 times $45\frac{5}{8} = 365$.
8 times $17\frac{3}{4} = 142$.

$$\begin{array}{r} 2\frac{81}{142}, \text{ Ans.} \\ 142\overline{)365} \\ \underline{284} \\ 81\frac{81}{142} \end{array}$$

Or: inverting the fraction by which we divide:

$45\frac{5}{8} \div 17\frac{3}{4} = \frac{365}{8} \div \frac{71}{4} = \frac{365}{8} \times \frac{4}{71}$.

$$\frac{365}{\underset{2}{\cancel{8}}} \times \frac{\cancel{4}}{71} = \frac{365}{142} = 2\frac{81}{142}, \text{ Ans.}$$

Written Exercises

1 Divide $3\frac{7}{8}$ by $4\frac{1}{4}$.
2 Divide $5\frac{3}{7}$ by $3\frac{1}{2}$.
3 Divide $9\frac{2}{3}$ by $5\frac{2}{3}$.
4 Divide $6\frac{5}{6}$ by $2\frac{4}{7}$.
5 Divide $2\frac{4}{7}$ by $1\frac{1}{3}$.
6 Divide $8\frac{3}{8}$ by $6\frac{3}{4}$.
7 Divide $13\frac{3}{4}$ by $8\frac{1}{3}$.
8 Divide $12\frac{4}{5}$ by $6\frac{3}{10}$.
9 Divide $17\frac{2}{5}$ by $3\frac{1}{5}$.
10 Divide $14\frac{5}{8}$ by $2\frac{9}{16}$.

Find the value of

11 $11\frac{4}{7} \div 4\frac{4}{5}$.
12 $19\frac{2}{5} \div 7\frac{5}{9}$.
13 $14\frac{4}{9} \div 8\frac{3}{8}$.
14 $21\frac{3}{7} \div 5\frac{6}{11}$.
15 $27\frac{7}{10} \div 9\frac{10}{13}$.
16 $12\frac{7}{8} \div 3\frac{7}{10}$.
17 $16\frac{11}{16} \div 2\frac{4}{13}$.
18 $24\frac{7}{12} \div 8\frac{9}{11}$.
19 $32\frac{5}{8} \div 12\frac{11}{13}$.
20 $40\frac{7}{9} \div 14\frac{9}{16}$.

21 $45\frac{3}{4} \div 17\frac{1}{8}$.
22 $53\frac{15}{16} \div 26\frac{5}{12}$.
23 $37\frac{3}{8} \div 18\frac{3}{4}$.
24 $62\frac{5}{7} \times 21\frac{1}{7}$.
25 $71\frac{1}{4} \div 35\frac{5}{8}$.
26 $28\frac{4}{7} \div 13\frac{3}{8}$.
27 $63\frac{1}{6} \div 24\frac{4}{5}$.
28 $112\frac{5}{8} \div 73\frac{9}{16}$.
29 $213\frac{4}{11} \div 91\frac{1}{3}$.
30 $489\frac{1}{4} \div 122\frac{9}{16}$.

31 At $12\frac{1}{2}$ cents a yard, how many yards of cloth can be bought for $87\frac{1}{2}$ cents?

32 How many dozen oranges at $22\frac{1}{2}$ cents a dozen can be bought for $67\frac{1}{2}$ cents?

33 How many steps $2\frac{1}{4}$ feet long will be required to travel $83\frac{1}{4}$ feet?

34 What is the price of cloth when $11\frac{3}{8}$ yards can be bought for \$$37\frac{4}{5}$?

35 How many packages weighing $9\frac{3}{8}$ ounces each would be required to make up a case weighing $440\frac{5}{8}$ ounces?

36 What is the average rate of a train which goes $212\frac{5}{6}$ miles in $6\frac{4}{5}$ hours?

37 How fast does a man row in going $27\frac{15}{16}$ miles in $5\frac{4}{15}$ hours?

38 How long will it take a man to cut $13\frac{4}{7}$ cords of wood at the rate of $2\frac{1}{12}$ cords a day?

39 How many times can a rod $10\frac{1}{12}$ feet long be laid off on a line $141\frac{1}{6}$ feet long?

40 How many times is $13\frac{5}{12}$ contained in $67\frac{4}{5}$?

COMPLEX FRACTIONS

$\frac{3\frac{1}{2}}{4}$, $\frac{3}{4\frac{1}{4}}$, $\frac{5\frac{1}{3}}{7\frac{5}{8}}$ are complex fractions.

A complex fraction can be changed to a simple fraction. It is then said to be simplified.

Such expressions as are given above are expressions of division: $3\frac{1}{2} \div 4$, $3 \div 4\frac{1}{4}$, $5\frac{1}{3} \div 7\frac{5}{8}$.

To simplify such expressions, one has only to divide: for example, $3\frac{1}{2} \div 4 = \frac{7}{8}$.

$\frac{3\frac{1}{2}}{4} = \frac{7}{8}$, which is in its simplest form.

Written Exercises

1 $\frac{5\frac{1}{2}}{7}$

2 $\frac{17\frac{2}{3}}{8}$

3 $\frac{1\frac{7}{8}}{10}$

4 $\frac{9\frac{3}{5}}{12}$

5 $\frac{8\frac{1}{3}}{13}$

6 $\frac{5}{4\frac{1}{2}}$

7 $\frac{9}{6\frac{2}{3}}$

8 $\frac{15}{4\frac{1}{2}}$

9 $\frac{25}{8\frac{1}{3}}$

10 $\frac{12}{9\frac{3}{5}}$

11 $\frac{5\frac{1}{2}}{7\frac{1}{3}}$

12 $\frac{4\frac{2}{3}}{8\frac{1}{4}}$

13 $\frac{10\frac{1}{5}}{5\frac{2}{3}}$

14 $\frac{4\frac{1}{5}}{2\frac{1}{10}}$

15 $\frac{\frac{1}{2}}{\frac{1}{4}}$

16 $\frac{17\frac{1}{2}}{8\frac{3}{4}}$

17 $\frac{14\frac{2}{3}}{\frac{5}{11}}$

18 $\frac{9\frac{5}{8}}{2\frac{1}{5}}$

19 $\frac{2\frac{1}{2}}{3\frac{1}{8}}$

20 $\frac{11\frac{1}{6}}{3\frac{1}{3}}$

21 $\frac{6\frac{1}{4}}{51\frac{2}{3}}$

22 $\frac{175}{13\frac{1}{3}}$

23 $\frac{6\frac{1}{4}}{7\frac{1}{7}}$

24 $\frac{16\frac{1}{2}}{132}$

25 $\frac{18\frac{2}{3}}{4\frac{2}{3}}$

26 $\frac{125\frac{2}{3}}{100\frac{1}{4}}$

27 $\frac{93\frac{1}{2}}{725}$

28 $\frac{75\frac{1}{3}}{9\frac{3}{5}}$

29 $\frac{19\frac{2}{3}}{6\frac{1}{3}}$

30 $\frac{14\frac{7}{16}}{7\frac{1}{6}}$

31 How many rods are there in $25\frac{1}{3}$ yards, (1 rod $= 5\frac{1}{2}$ yd.)?

32 How many times will a measure that holds $3\frac{1}{4}$ quarts have to be filled to measure $38\frac{1}{8}$ quarts?

33 A man having $\$41\frac{1}{4}$, will give $\$4\frac{1}{3}$ to each of several boys. What is the largest number of boys that can receive a share and how much money will be left over?

34 A lot of land $136\frac{1}{3}$ feet long is how many times as long as a lot whose length is $71\frac{1}{2}$ feet?

35 In $16\frac{5}{8}$ bushels there are how many quarter-bushels?

36 If a train runs $26\frac{2}{3}$ miles per hour, how many hours will it take to run $416\frac{2}{3}$ miles?

37 If a boy runs $6\frac{1}{2}$ miles in one hour, how long will it take him to run $2\frac{1}{4}$ miles?

38 A man having $\$37\frac{1}{2}$ has how many times as much money as a boy who has $\$8\frac{1}{3}$?

39 This same boy has how many times as much as another b who has $\$12\frac{1}{2}$?

40 If a yard of cloth costs $\$\frac{7}{8}$, how many yards can be boug for $\$35\frac{3}{8}$?

To find what part one number is of another

Illustration:

I. \$7.00 is what part of \$24.50?

$\$7.00=\left\{\frac{7.}{24.50}\right\}$ or $\frac{700}{2450}$ or $\frac{70}{245}$ or $\frac{2}{7}$ of \$24.50.

$\frac{2}{7}$, Ans.

II. 3 is what part of $10\frac{1}{3}$?

$3=\left\{\frac{3}{10\frac{1}{3}}\right\}$ or $\frac{9}{31}$ of $10\frac{1}{3}$.

$\frac{9}{31}$, Ans.

III. $\$2\frac{1}{5}$ is what part of $\$7\frac{1}{6}$?

$\$2\frac{1}{5}=\frac{2\frac{1}{5}}{7\frac{1}{6}}$ of $\$7\frac{1}{6}$.

$\frac{2\frac{1}{5}}{7\frac{1}{6}}=2\frac{1}{5}\div 7\frac{1}{6}$.

$\frac{11}{5}\div\frac{43}{6}=\frac{11}{5}\times\frac{6}{43}=\frac{66}{215}$, Ans.

IV. 4 is what part of $2\frac{1}{2}$?

$4=\frac{4}{2\frac{1}{2}}$ or $\frac{8}{5}$ of $2\frac{1}{2}$.

$\frac{8}{5}$, Ans.

Oral Exercises

1 7 is what part of 12?
2 16 is what part of 24?
3 35 is what part of 20?
4 49 is what part of 56?
5 56 is what part of 8?
6 18 is what part of 27?
7 27 is what part of 18?
8 75 is what part of 125?
9 12 is what part of 42?
10 14 is what part of 36?
11 21 is what part of 35?
12 24 is what part of 64?
13 35 is what part of 60?
14 42 is what part of 63?
15 49 is what part of 70?
16 81 is what part of 36?
17 56 is what part of 72?
18 50 is what part of 8?

19 34 is what part of 51?
20 51 is what part of 34?
21 18 is what part of 72?
22 27 is what part of 39?
23 14 is what part of 56?
24 28 is what part of 63?
25 39 is what part of 52?
26 40 is what part of 35?
27 42 is what part of 56?
28 44 is what part of 33?
29 22 is what part of 121?
30 21 is what part of 147?

Written Exercises

1 231 is what part of 455?
2 208 is what part of 520?
3 315 is what part of 399?
4 68 is what part of 204?
5 144 is what part of 1728?
6 153 is what part of 189?
7 480 is what part of 576?
8 615 is what part of 492?
9 238 is what part of 294?
10 460 is what part of 322?

To find a number when the fractional part is given

Illustration:

I. 8 is $\frac{4}{5}$ of what number?
$\frac{4}{5}$ of the number $= 8$.
$\frac{1}{5}$ of the number $= \frac{1}{4}$ of $8 = 2$.
$\frac{5}{5}$ of the number $= 5$ times 2 or 10, Ans.

II. $3\frac{1}{3}$ is $\frac{3}{8}$ of what number?
$\frac{3}{8}$ of the number $= 3\frac{1}{3}$.
$\frac{1}{8}$ of the number $= \frac{1}{3}$ of $3\frac{1}{3} = \frac{1}{3}$ of $\frac{10}{3} = \frac{10}{9}$.
$\frac{8}{8}$ of the number $= 8$ times $\frac{10}{9} = \frac{80}{9} = 8\frac{8}{9}$, Ans.

III. 4.25 is $\frac{5}{16}$ of what number?
$\frac{5}{16}$ of the number $= 4.25$.
$\frac{1}{16}$ of the number $= \frac{1}{5}$ of $4.25 = .85$.
$\frac{16}{16}$ of the number $= 16$ times $.85 = 13.6$, Ans.

Oral Exercises

1 7 is $\frac{1}{5}$ of what number?
2 6 is $\frac{2}{3}$ of what number?
3 10 is $\frac{5}{12}$ of what number?
4 14 is $\frac{7}{9}$ of what number
5 18 is $\frac{3}{10}$ of what number?
6 24 is $\frac{4}{5}$ of what number?
7 20 is $\frac{2}{7}$ of what number?
8 19 is $\frac{1}{2}$ of what number?
9 21 is $\frac{7}{9}$ of what number?
10 49 is $\frac{7}{8}$ of what number?
11 24 is $\frac{3}{16}$ of what number?
12 30 is $\frac{3}{8}$ of what number?

13 27 is $\frac{9}{11}$ of what number?
14 42 is $\frac{3}{4}$ of what number?
15 45 is $\frac{15}{16}$ of what number?
16 32 is $\frac{2}{3}$ of what number?
17 35 is $\frac{5}{7}$ of what number?
18 33 is $\frac{11}{13}$ of what number?
19 55 is $\frac{5}{11}$ of what number?
20 42 is $\frac{13}{14}$ of what number?
21 51 is $\frac{3}{4}$ of what number?
22 39 is $\frac{13}{16}$ of what number?
23 16 is $\frac{8}{9}$ of what number?
24 34 is $\frac{17}{21}$ of what number?
25 39 is $\frac{3}{5}$ of what number?
26 42 is $\frac{3}{5}$ of what number?
27 75 is $\frac{5}{6}$ of what number?
28 63 is $\frac{7}{12}$ of what number?
29 45 is $\frac{5}{9}$ of what number?
30 51 is $\frac{17}{24}$ of what number?

Written Exercises

1 640 is $\frac{32}{45}$ of what number?
2 31 is $\frac{5}{8}$ of what number?
3 73 is $\frac{7}{16}$ of what number?
4 60 is $\frac{11}{12}$ of what number?
5 146 is $\frac{9}{11}$ of what number?
6 91 is $\frac{3}{12}$ of what number?
7 89 is $\frac{14}{15}$ of what number?
8 47 is $\frac{11}{32}$ of what number?
9 163 is $\frac{27}{41}$ of what number?
10 141 is $\frac{7}{13}$ of what number?

To change common fractions to decimals

Illustration:

I. To change $\frac{5}{8}$ to a decimal.

$\frac{5}{8} = 5 \div 8.$

Performing the division as in decimals by adding ciphers to the number divided.

$8.\overline{)5.000}$
$.625$, Ans

Written Exercises

Change the following to decimals. (Answer to the nearest thousandth.)

1 $\frac{3}{8}$
2 $\frac{5}{16}$
3 $\frac{4}{9}$
4 $\frac{7}{9}$
5 $\frac{8}{11}$
6 $\frac{14}{15}$
7 $\frac{13}{15}$
8 $\frac{8}{9}$
9 $\frac{7}{12}$
10 $\frac{16}{21}$
11 $\frac{14}{17}$
12 $\frac{11}{12}$
13 $\frac{7}{16}$
14 $\frac{5}{14}$
15 $\frac{12}{13}$
16 $\frac{6}{17}$
17 $\frac{14}{19}$
18 $\frac{8}{25}$
19 $\frac{15}{19}$
20 $\frac{9}{14}$
21 $\frac{5}{8}$
22 $\frac{11}{15}$
23 $\frac{24}{37}$
24 $\frac{1}{6}$
25 $\frac{18}{23}$
26 $\frac{5}{11}$
27 $\frac{4}{7}$
28 $\frac{6}{13}$
29 $\frac{124}{125}$
30 $\frac{87}{91}$

31 Change $\frac{5}{8}$ bu. to a decimal of a bushel.
32 Change \$$\frac{6}{25}$ to a decimal of a dollar.
33 Change $\frac{124}{131}$° to a decimal of a degree.
34 Change $\frac{8}{19}$ yd. to a decimal of a yard.
35 Change $\frac{8}{15}$ mi. to a decimal of a mile.

To change decimals to common fractions

Illustration:

I. To change .875 to a common fraction.

When .875 is read, we say 875 thousandths. Write it as 875 one-thousandths, thus $\frac{875}{1000}$. It is now in the form of a common fraction, but not in its lowest terms. $\frac{875}{1000} = \frac{7}{8}$, Ans.

Written Exercises

Change to common fractions:

1 .22
2 .58
3 .42
4 .74
5 .325
6 .625
7 .845
8 .225
9 .375
10 .825
11 .125
12 .275
13 .6125
14 .4875
15 .4826
16 .1054
17 .0825
18 .0375
19 .0025
20 .8125
21 .7825
22 .0875
23 .21875
24 .32125
25 .4520
26 .6875
27 .0768
28 .1728
29 .09$\frac{1}{11}$
30 .11$\frac{1}{9}$
31 .428$\frac{4}{7}$
32 .555$\frac{5}{9}$
33 .9166$\frac{2}{3}$

34 What fractional part of a dollar is \$0.875?
35 What fractional part of a dollar is \$0.3125?

DIVISION—COMPOUND NUMBERS

Illustrations:

I. Divide 29 sq. yd. 7 sq. ft. 24 sq. in. by 6.

$$\begin{array}{rrrr} & 4\text{ sq. yd.} & 8\text{ sq. ft.} & 100\text{ sq. i} \\ \cline{2-4} 6) & 29\text{ sq. yd.} & 7\text{ sq. ft.} & 24\text{ sq. i} \\ & \underline{24} & \underline{45} & \underline{576} \\ & 5 & 52 & 600 \\ & & \underline{48} & \\ & & 4 & \end{array}$$

29 sq. yd. ÷ 6 = 4 sq. yd. and
5 sq. yd. over.
5 sq. yd. = 45 sq. ft.
7 sq. ft. + 45 sq. ft. = 52 sq. ft.
52 sq. ft. ÷ 6 = 8 sq. ft. and 4 sq. ft. over.
4 sq. ft. = 576 sq. in.
24 sq. in. + 576 sq. in. = 600 sq. in.
600 sq. in. ÷ 6 = 100 sq. in.

II. Divide 5 mi. 76 rd. 1 yd. 11 in. by 41.

$$\begin{array}{rrrrrr} & & 40\text{ rd.} & 4\text{ yd.} & 2\text{ ft.} & 7\text{ in.} \\ \cline{2-6} 41) & 5\text{ mi.} & 76\text{ rd.} & 1\text{ yd.} & & 11\text{ in.} \\ & & \underline{1600} & \underline{198} & 105 & \underline{276} \\ & & 1676 & 199 & \underline{82} & 287 \\ & & \underline{164} & \underline{164} & 23 & \underline{287} \\ & & 36 & 35 & & \end{array}$$

5 mi. = 1,600 rd.
76 rd. + 1,600 rd. = 1,676 rd.
1,676 rd. ÷ 41 = 40 rd. and 36 rd. over.
36 rd. = 198 yd.
1 yd. + 198 yd. = 199 yd.
199 yd. ÷ 41 = 4 yd. and 35 yd. over.
35 yd. = 105 ft.
105 ft. ÷ 41 = 2 ft. and 23 ft. over.
23 ft. = 276 in.
11 in. + 276 in. = 287 in
287 in. ÷ 41 = 7 in.

III. Divide 529 cu. yd. 17 cu. ft. 1,400 cu. in. by 5 cu. yd. 8 cu. ft. 14 cu. in.

(Change to cu. in.)

529 cu. yd. 17 cu. ft. 1,400 cu. in. = 24,710,400 cu. in

5 cu. yd. 8 cu. ft. 14 cu. in. = 247,104 cu. in.

```
              100 times, Ans
247104)24710400
       247104
         0000
```

Written Exercises

1 A house of 10 rooms used 362 sq. yd. 7 sq. ft. 10 sq. in. of carpet. What was the average amount required for each room?

2 In making 15 trips between two cities, a steamer used 35 days 14 hours 30 minutes. What was the average time per trip?

3 A lot of land containing 15 acres 120 sq. rd. 20 sq. yd. 2 sq. ft. 15 sq. in. is divided into 30 equal lots. How large is each lot?

4 Thirty-five loads of wood measured 50 cd. 6 cd. ft. 10 cu ft. What was the average size of the loads?

5 Divide 14 wk. 6 da. 16 hr. 30 min. 20 sec. by 10.

6 Thirty pieces of cloth contained 743 yd. 10 in. What was the average length per piece?

7 In 8 hours a train travels 263 mi. 120 rd. 5 yd. 2 ft. 4 in. How far does it travel per hour?

8 The total time used in making 24 trips between two ports was 36 wk. 7 hr. 5 min. What was the average length of the trips?

9 98 cu. yd. 6 cu. ft. 72 cu. in. of earth was removed in 90 loads. What was the average size of the loads?

10 Eight farms raised 984 bu. 3 pk. 7 qt. of potatoes. What did each farm yield, all yielding equal amounts?

11 If a sack holds 1 bu. 3 pk. 7½ qt. how many sacks would be needed for the potatoes in the preceding example?

12 Six equal loads of coal weighed 7 T. 28 cwt. 70 lb. What was the weight of each load?

13 *Divide* 2 lb. 7 oz. 19 pwt. by 5 oz. 6 pwt. 12 gr.

14 29 bu. 3 pk. 3 qt. of potatoes was divided among a certain number of men, each man receiving 5 bu. 3 pk. 7 qt. How many men were there?

15 15 bu. 3 pk. 2 qt. of beans was placed in 10 equal boxes. How much was placed in each box?

16 How many strings 4 yd. 2 ft. 3 in. long can be cut from a ball of twine containing 113 rd. 3 yd. 2 ft. 10 in.?

17 How many boxes, each holding 1 bu. 2 pk. 3 qt. can be filled from a bin holding 96 bu. 3 pk. 5 qt. 1 pt.?

18 The distance around a square field is 193 rds. 2 yd. 1 ft 4 in. What is the length of each side?

19 How many bars of iron, each weighing 35 lb. 6 oz. will it take to weigh a ton?

20 A man who owned 260 acres of land, sold 110 A. 30 sq. rd 3 sq. ft. The rest he divided equally among his five children How much did each child receive?

MEASUREMENTS—LINEAR

Linear or length measure includes the following units: inch, foot, yard, rod, mile.

The **Perimeter** of a plane surface is the length of the bounding line which surrounds it.

The perimeter of a 9-inch square is 36 in. The perimeter of a square-cornered room which is 20 ft. long and 17 ft. wide is 74 ft. Two sides are 20 feet each and two sides are 17 feet each; 20 ft. + 20 ft. + 17 ft. + 17 ft. = 74 ft.

MEASUREMENTS—CIRCLES

The **Circumference** of a circle is the curved line which surrounds it.

The **Diameter** of a circle is a straight line passing through its center and terminating at either end in the circumference.

A **Radius** of a circle is a straight line passing between its center and the circumference. A radius is a half-diameter.

$$\text{The Circumference} = \begin{cases} \text{3.1416 times the diameter.} \\ \text{3.1416 times twice the radius.} \end{cases}$$

$$\text{The Diameter} = \begin{cases} \text{the circumference} \div 3.1416. \\ \text{two times the radius.} \end{cases}$$

$$\text{The Radius} = \begin{cases} \text{the diameter} \div 2. \\ \text{one-half ot the circumference} \div 3.1416. \end{cases}$$

Note: The above relations must be *learned*.

Illustrations:

I. To find the circumference of a 40-foot circle.

Diameter = 40 ft.

Circumference = 3.1416 × 40 ft. = 125.664 ft., Ans.

The size of most circular objects is expressed by naming the length of the diameter. The size of rope is expressed either by *naming the* length of the circumference, or the length of the *diameter.*

II. To find the circumference of a circle whose radius is 5 ft.

Radius = 5 ft.
Diameter = 2 × 5 ft. = 10 ft.
Circumference = 3.1416 × 10 ft. = 31.416 ft., Ans.

III. To find the diameter of a circle whose circumference is 15.708 ft.

15.708 ft. ÷ 3.1416 = 5 ft., Ans.

IV To find the diameter of a circle whose radius is 85 feet.

2 × 85 ft. = 170 ft., Ans.

V. To find the radius of a circle whose diameter is 75 ft.

75 ft. ÷ 2 = 37½ ft., Ans.

VI. To find the radius of a circle whose circumference is 62.832 in.

62.832 in. ÷ 3.1416 = 20 in., diameter.
20 in. ÷ 2 = 10 in., Ans.

Written Exercises

1 Find the circumference of a 36 ft. circle.

2 Find the circumference of a 14 in. circle.

3 Find the circumference of a circle that has a diameter of 8 yd.

4 How far is it around a 6½ ft. drive-wheel?

5 What is the distance around a circular lot that has a diameter of 123 feet?

6 Find the circumference of a circle whose radius is 36 ft.

7 Find the circumference of a circle whose radius is 18 in.

8 Find the circumference of a circle whose radius is 3 yd.

9 How far is it around a wheel which is 3½ feet from the center of the hub to the outside of the rim?

10 A cow being tied to a stake by a 40-foot chain is allowed to travel around the stake. What is the circumference of the largest circle in which the cow can travel?

11 Find the diameter of a circle whose circumference is 628. 32 ft.

12 Find the diameter of a circle whose circumference is 1884. 96 ft.

13 Find the diameter of a circle whose circumference is 845 ft.

14 What is the diameter of a wheel whose circumference is 8 yd.?

15 What is the lowest door through which a man can roll a wheel whose circumference is 18 ft.?

16 What is the diameter of a circle whose radius is 8 ft.?

17 What is the diameter of a circle whose radius is 14 yd.?

18 What is the diameter of a circle whose radius is 16 in.?

19 How high is a wheel whose radius is 3¼ ft.?

20 Find the longest distance across a wheel which is 2⅓ ft. from the center of the hub to the outside of the rim.

21 Find the radius of a 12-ft. circle.

22 Find the radius of a 6-in. circle.

23 How long a spoke should a wheelwright plan for a 4½-ft wagon wheel making no allowance for hub and rim?

24 How much does the diameter exceed the radius in a 3-in. disc?

25 Dividing the diameter of any circle by 2 gives for a result the length of what dimension of a circle?

26 Find the radius of a circle whose circumference is 60 feet.

27 Find the radius of a circle whose circumference is 85½ feet.

28 How long should a spoke be made for a wheel whose circumference is 18¼ feet, making no allowance for hub or rim?

29 That a cow may feed over a circle whose circumference is 140 feet, how long should the rope be that reaches from the halter to a stake in the center of the circle?

30 Find the radius of a circle whose circumference is 062832 miles.

MEASUREMENTS—SURFACE

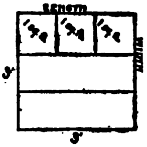
Surface measure includes the following **units: square** inch square foot, square yard, square rod, acre, square mile.

In measuring surface two dimensions are necessary, the length and the width.

The Square

In a square both dimensions are the same. A three-foot square is three feet long and three feet wide.

To find the area of a three-foot square.



1 ft. of the width = 3 sq. ft.

3 ft. of the width = 3 times 3 sq. ft. or 9 sq. ft., Ans.

or

3 sq. ft. multiplied by 3 = 9 sq. ft., Ans.

The Rectangle

A rectangle has four straight sides which form four square corners.

To find the area of a rectangle which is 14 feet long and 10 feet wide.

1 ft. of the width = 14 sq. ft.

10 ft. of the width = 10 times 14 sq. ft. or 140 sq. ft., Ans.

or

$$\begin{array}{rl} & 14 \text{ sq. ft.} \\ \text{multiplied by} & \underline{10} \\ & 140 \text{ sq. ft., Ans.} \end{array}$$

Before computing the area of a plane surface, the dimensions must be expressed in the same denomination.

To find the area of a rectangle which is 5 yards long and 10 feet, 6 inches wide.

$$\text{The above rectangle is} \begin{cases} 5 \text{ yds. long and } 3\frac{1}{2} \text{ yds. wide.} \\ 15 \text{ ft. long and } 10\frac{1}{2} \text{ ft. wide.} \\ 180 \text{ in. long and } 126 \text{ in. wide.} \end{cases}$$

Any of these sets of dimensions may be used in finding the area.

Written Exercises

Find the areas of rectangles having the following dimensions:

1 2⅓ ft. square.
2 7⅜ yd. long by 5$\frac{1}{12}$ yd. wide
3 10¼ rd. long, 3⅜ rd. wide.
4 8$\frac{7}{12}$ yd. square.
5 32 ft. long, 4⅞ yd. wide.
6 27 in. by ¾ ft.
7 220 yd. by ¼ mi.
8 9 ft. 3 in. square.
9 5 rd. 2 ft. 9 in. × 3 rd. 8¼ ft
10 14 yd. 8 in. × ½ rd.

11 How many square feet of land in a city lot 62½ ft. front the depth being 125 ft.?

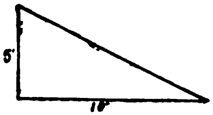
12 How many square inches in a photograph 3¼ × 4¼ inches?

13 How many square yards in a concrete walk 90 ft. long and 27 in. wide?

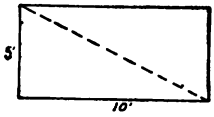
14 How many square feet of glass are there in a two-light window, each light measuring 30 × 36 inches?

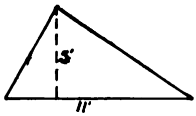
15 How many square rods in a field 408 rd. long and 122 rd. wide?

The Triangle

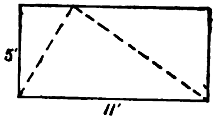


= ½ of





= ½ of



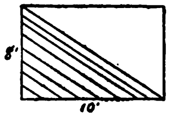
The area of a triangle is equal to one-half the area of a rectangle which has a length equal to one side of the triangle and a width equal to the shortest distance from that side to the opposite corner of the triangle.

One of the dimensions must be equal to the shortest distance from a corner to the opposite side and the other dimension is the *length of that* "opposite side." This "shortest distance" is often called the altitude, the perpendicular, or the height; the "opposite side" is often called the base.

To find the area of a triangular flower-bed, one corner of which is square The sides forming the square corner are 8 feet and 10 feet in length.

The area of a rectangle 8 ft. by 10 ft. = 80 sq. ft.

The area of a triangle of the same dimensions = ½ of 80 sq. ft. or 40 sq. ft., Ans.



To find the area of a triangle whose base is 18 feet and whose altitude is 8 feet.

A rectangle of the above dimensions = 144 sq. ft.

A triangle of the above dimensions = ½ of 144 sq. ft. or 72 sq. ft., Ans.

Written Exercises.

1 Find the area of a triangular lot 87½ ft. by 100 ft.

2 Find the area of a triangular lot 316 ft. by 124 ft.

3 How many square feet are there in a triangular flower-bed 13½ ft. long and 6⅜ ft. wide?

4 How many square feet in the gable end of a house 32 feet wide, the ridge being 12 ft. above the level of the eaves?

5 How many square feet are there in two triangular lots of land, each being 320 ft. long and 116 ft. wide?

6 Which is larger and how much, a rectangular lot 72 ft. by 100 ft., or a triangular lot 90 ft. by 150 ft.?

7 The two gable ends of a house 30 ft. wide will require how many sq. ft. of boards, the ridge being 14 ft. above the level of the eaves?

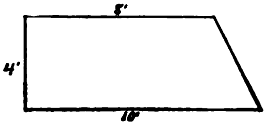
8 What is the value at 30 cents per square foot of a triangular lot of land whose base is 160 ft. and whose altitude is 220 ft.?

9 Find the number of square yards in a triangle 64 ft. by 92 ft.?

10 *How many square* feet in a triangle 17 in. by 25 in.?

Irregular Surfaces

Many irregular surfaces may be resolved into rectangles; or into rectangles and triangles, the area of each to be found separately and the results added.



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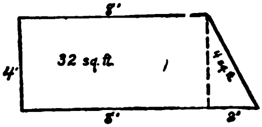
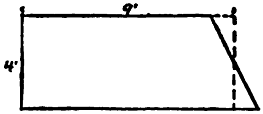
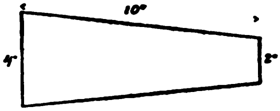


or



The average length is 9 ft.

The area = 36 sq. ft.



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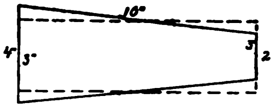


The average width is 3 in. The area is 30 sq. in.

To find the number of square feet in the top surface of a board which is 15 in. wide at one end, 9 in. wide at the other end and 14 ft. long.

The average width = 12 in. or 1 ft.

The area of the top surface is equal to the area of a rectangle 1 ft. wide and 14 ft. long, which is 14 sq. ft.

The average of two widths is half their sum.

The average of 8 ft. and 10 ft.

10 ft.
+8
2)18
9 ft., Ans

The average of 4 in. and 2 in.

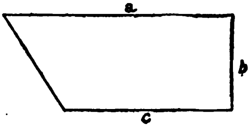
$$\begin{array}{r} 4 \\ +2 \\ \hline 2\overline{)6} \\ 3 \text{ in., Ans.} \end{array}$$

The average of 15 in. and 9 in.

$$\begin{array}{r} 15 \\ +9 \\ \hline 2\overline{)24} \\ 12 \text{ in., Ans.} \end{array}$$

Written Exercises

Find the area of a surface shaped thus:



1 When a = 90 ft., b = 40 ft., c = 80 ft.
2 When a = 8 rd., b = 7 rd., c = 6 rd.
3 When a = 27 in. b = 8 in., c = 24 in.
4 When a = 1 mi., b = 100 yd., c = $\frac{7}{8}$ mi.
5 When a = 42 in., b = $\frac{2}{3}$ ft., c = 1 yd. 4 in.

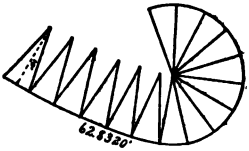
Find the number of square feet in the top surface in each of the following boards:

6 Length, 12 ft., widths at the ends, 7 and 9 in.
7 Length, 9 ft., widths at the ends, 7 and 5 in.
8 Length, 10 ft., widths at the ends, 11 and 13 in.
9 Length, 8 ft., widths at the ends, 8 and 10 in.
10 Length, 14 ft., widths at the ends, 3 and 5 in.

The Circle

A circle may be thought of as consisting of a great many triangles whose bases form the circumference and whose altitudes are the radii.

The area of these triangles is the same as the area of the *circle. One* dimension of all the triangles taken together forms *the length of the* circumference, the other dimension is the radius.



To find the area of a circle whose diameter is 20 feet.

3.1416
20 ft.
The circumference is 62.8320 ft.
The radius is 2)20
10 ft.

62.832 sq. ft.
The area is one-half of 10
628.320 sq. ft.

½ of 628.32 sq. ft. = 314.16 sq. ft., Ans.

A shorter method:

The radius is 2)20 ft.
10 ft.

Multiply the radius by itself 10
10
100

Multiply the product by 3.1416 3.1416
100
Area in square feet 314.1600, Ans.

(This shorter method is recommended.)

Written Exercises

1 Find the area of a 6 foot circle.

2 How many square feet in a circle whose circumference is 314.16 ft.?

3 Find the area of a 12½ foot wheel.

4 How many square inches in the area of a circular looking-glass having a radius of 10 in.?

5 Find the area over which a cow may feed when tied to a stake with a 40 foot chain.

6 What is the area of the land enclosed within a circular race track, the enclosed space being 90 rods in diameter?

7 Find the area of a circle whose radius is ½ rod.

8 Find the area of the top surface of an emery disc which measures .875 in. in diameter.

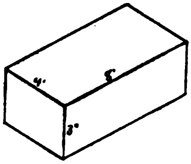
9 How much greater is the area of a 10 foot circle than the area of a 9 foot circle?

10 How many square feet are there in a circular dining table whose diameter is 45 in.?

The Rectangular Prism

The rectangular prism has six rectangular faces or surfaces, the size of which is indicated in the dimensions.

To find the surface area of a rectangular prism whose length is 8 feet, whose width is 4 feet, and whose height is 3 feet.



The surfaces are:

The top and the bottom, 4 ft. by 8 ft.
Two ends, 3 ft. by 4 ft.
Two sides, 3 ft. by 8 ft.

	8 sq. ft.		4 sq. ft.		8 sq. ft.
Area of	× 4	Area of	× 3	Area of	× 3
top,	32 sq. ft.	end,	12 sq. ft.	side,	24 sq. ft.
Area of	× 2	Area of	× 2	Area of	× 2
top and bottom,	64 sq. ft.	2 ends	24 sq. ft.	2 sides,	48 sq. ft.

Add	64 sq. ft.
	24 sq. ft.
	48 sq. ft.
Total area	136 sq. ft., Ans.

Written Exercises

1 *Find* the surface area of a rectangular prism 12 ft. long *8 ft. wide, and 5 ft. high.*

2 What is the surface area of a box 3 ft. long, 2 ft. wide, and 1½ ft. high?

3 How many square feet in the surface of a wood pile 20 ft. long, 6 ft. high, and 4 ft. wide?

4 In the surface of a box 30 in. long, 15 in. wide and 6 in. deep, there are how many square feet of lumber?

5 How many square yards are there in the walls, floors, and ceiling of a room 14 ft., by 12 ft. by 8 ft.?

6 How many more square yards of plastering are there in a room 16 ft. by 15 ft. by 9 ft., than in a room 18 ft. by 10 ft., by 8 ft.?

7 How many square feet of boards are required to cover the walls of a chicken house which is 20 ft. long, 8 ft. wide, and 6 ft. high, allowing for what is saved on windows and door to cover the gable ends?

8 If the paint to cover a box 4 ft. by 3 ft. by 2 ft. costs 15 cents, how much will it cost to paint a box 8 ft. × 6 ft. × 4 ft.?

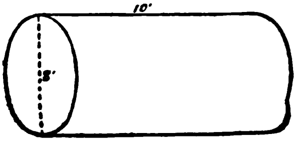
9 How many square feet of lead will it take to line the bottom and sides of a tank 2 ft. by ½ yd. by 15 in.?

10 How many square feet of lumber will be needed to make 30 boxes 3 ft. long, 2 ft. wide, and 2 ft. deep, reckoning the waste as equal to one-fifth of amount actually used?

The Cylinder

The cylinder has three surfaces, the two circular ends, which are equal, and the curved surface, which is equal to a rectangle having for one dimension the circumference of the end and for the other dimension the height or length of the cylinder.

To find the surface area of a cylinder whose diameter is 8 feet and whose height or length is 10 feet.



$$
\begin{array}{lrr}
 & & 3.1416 \\
\text{The area of one end} = 2)8(4 & 4 & \times 16 \\ \cline{3-3}
 & \times 4 & 188496 \\ \cline{2-2}
 & 16 & 31416 \\ \cline{3-3}
 & & 50.2656 \text{ sq. ft.} \\
 & & \times 2 \\ \cline{3-3}
\text{The area of both ends} = & & 100.5312 \text{ sq. ft.}
\end{array}
$$

The circumference = 8 × 3.1416 = 25.1328 ft.

$$
\begin{array}{r}
25.1328 \text{ sq. ft.} \\
\times 10 \\ \hline
251.3280 \text{ sq. ft.}
\end{array}
$$

100.5312 sq. ft. + 251.328 sq. ft. = 351.8592 sq. ft., Ans.

Written Exercises

Find the number of square inches in the surface of each of the following cylinders:

1	Height	12 in.,	diameter	6 in.
2	"	8 in.,	"	8 in.
3	"	9 in.,	"	4 in.
4	"	16 in.,	"	9 in.
5	"	15 in.,	"	7 in.
6	"	14 in.,	"	10 in.
7	"	18 in.,	"	5 in.
8	"	1⅔ ft.,	"	9 in.
9	"	20 in.,	"	⅓ yd.
10	"	2½ ft.,	"	1¾ ft.

11 How much land will a roller, which has a diameter of 15 in. cover in making 120 revolutions?

12 How many square inches of surface are there in a 7 in. stove pipe 4 ft. long?

13 Find the number of square inches of tin required to make a pail 8 in. in diameter and 10 in. deep, assuming the cover to be a flat circular piece?

14 How many square feet of outside surface are there in a drain pipe 93 yd. long and 26 in. in diameter (outside)?

15 How many square inches of paper will be required to make a hollow cylinder (including ends) 10 in. long and 4 in. in diameter?

MEASUREMENTS—CARPETING

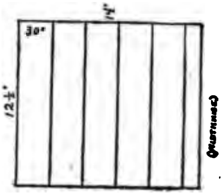
Carpets are laid in strips regardless of the number of square feet to be covered and of the number of square feet in a yard of carpeting. There is usually less waste in matching when the strips are laid lengthwise of the room but this may be counterbalanced by part of a strip to be wasted at the edge.

Allowance for matching is usually indicated in the problem. The allowance increases the amount of carpeting required.

A strip is the length of carpeting required to reach from one side of the room to the other.

Illustration:

Carpet a room 14 feet long and 12½ feet wide with carpeting 30 inches wide. Making no allowance for matching, how many yards are required?



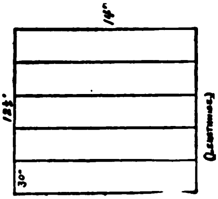
30 in. = 2½ ft.

14 ft. ÷ 2½ ft. = 5⅗ times, therefore 5⅗ strips.

6 strips are required, each 12½ ft. or 4⅙ yd. long.

6 times 4⅙ yd. = 25 yd., Ans.

or



30 in. = 2½ ft.

12½ ft. ÷ 2½ ft. = 5 times, therefore 5 strips.

5 strips are required, each 14 ft. or 4⅔ yd. long.

5 times 4⅔ yd. = 23⅓ yd., Ans.

Which is the better way to lay the carpet from the standpoint of economy?

Tiling is computed in a similar way.

Written Exercises

Find the number of yards of carpeting required for the following rooms, the strips running lengthwise, no allowance being made for waste in matching unless otherwise stated.

1 15 ft. by 21 ft., with carpet 27 in. wide.

2 12½ ft. by 15 ft., with carpet 2½ ft. wide.

3 18 ft. by 20 ft., with carpet 22 in. wide.

4 6 ft. by 18 ft., with carpet 24 in. wide.

5 15 ft. square, with carpet 30 in. wide.

6 14 ft. by 22 ft. with carpet ¾ yd. wide.

7 14 ft. by 18 ft., with carpet 2½ ft. wide.

8 10 ft. by 12 ft., with carpet 29 in. wide.

9-11 Find number of yards of carpeting required in Examples 6, 7 and 8, if the strips run widthwise of the room in each case.

12 Which way of the room should the strips be laid in order to carpet the following rooms most economically?

16 ft. by 21 ft., the carpet being 27 in. wide.

13 12 ft. by 20 ft., the carpet being 30 in. wide.

14 24 ft. by 36 ft., the carpet being 24 in. wide.

15 Find the number of yards required in Example 6, allowing 4 in. on each strip for waste in matching.

MEASUREMENTS—WALL PAPER

Wall paper is bought in single rolls and double rolls eighteen inches wide and containing eight yards and sixteen yards respectively. Border is sold by the yard.

Allowance for matching and for windows, doors, etc., is usually indicated in the problem; the former to increase and the latter to decrease the amount of paper required

A strip is the length of paper required to reach from the baseboard to the ceiling; or, if a border is used, to reach under the lower edge of the border.

Illustration:

To find how many rolls of wall paper are required for the walls of a room which is 18 feet long and 16 feet wide, with walls 12 feet high above the baseboard; allowing six yards for matching, and a deduction of six strips on account of two windows and a door

Distance around the room	18 18 16 16
18 in. = 1½ ft.	1½)68
Number of strips required	45⅓
	46 strips required
Deducting 6 strips	−6
	40
Length of 1 strip	×4 yd.
Length of 40 strips	160 yd.
6 yd. for matching	+6
	16)166 yd.
Number of double rolls	10
	with 6 yd. remaining

It will be necessary to purchase a full single roll to provide for the remaining six yards, therefore 10 double rolls, 1 single roll required, Ans.

If border were required it would take as many yards as there *are yards* around the room

Written Exercises

Find the number of rolls of wall paper required in the following cases, allowing 4 in. on each strip for matching, and deducting 4 strips in each case for openings.

1 Height above baseboard 8 ft.; floor 9×12 ft.

2 " " " 7½ ft.; floor 10×17 ft.

3 " " " 8 ft.; floor 12×20 ft.

4 " " " 8 ft. 4 in.; floor 15 ft. square.

5 " " " 7 ft. 10 in.; floor 15×18 ft.

6 " " " 8 ft. 2 in.; floor 16×21 ft.

7 " " " 7 ft. 8 in.; floor 18×22 ft.

8 " " " 8⅓ ft.; floor 15×20 ft.

9 " " " 8 ft. 3 in.; floor 20×24 ft.

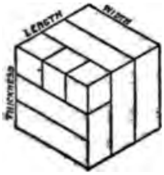
10 Find the number of rolls of paper and yards of border (2½ ft. wide) required in Example 4.

MEASUREMENTS—VOLUME

Measures of volume include the following units: cubic inch, cubic foot, cubic yard, gallon, bushel, board-foot, cord.

In measuring contents of volume, three dimensions are necessary; the length, the width, and the thickness.

The Cube



In a cube all dimensions are the same.

To find the contents of a three-foot cube.

1 ft. of the length and thickness = 3 cu. ft.

1 ft. of the length and 3 ft. of the thickness = 3 times 3 cu. ft. or 9 cu. ft.

3 ft. of the length and 3 ft. of the thickness = 3 times 9 cu. ft. or 27 cu. ft., Ans.

or

3 cu. ft.
multiplied by 3
9 cu. ft.
multiplied by 3
27 cu. ft., Ans.

The Rectangular Solid

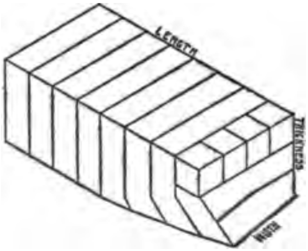
A rectangular solid is bounded by six rectangular surfaces or faces.

To find the contents of a rectangular solid 8 ft. long, 4 ft. wide and 3 ft. high.

1 ft. of the length and thickness = 4 cu. ft.

1 ft. of the length and 3 ft. of thickness = 3 times 4 cu. ft. or 12 cu. ft.

8 ft. of length and 3 ft. of thickness = 8 times 12 cu. ft. = 96 *cu. ft.*, Ans.



or

	4 cu. ft.
multiplied by	3
	12 cu. ft.
multiplied by	8
	96 cu. ft., Ans.

Before computing the contents of a solid the dimensions should be expressed in the same denomination.

To find the contents of a rectangular solid which is 3 yd. long, 4 ft. 6 in. wide and 6 in. thick.

The above solid is
- a 3 yds. long, 1½ yd. wide and ⅙ yd. thick.
- b 9 ft. long, 4½ ft. wide and ½ ft. thick.
- c 108 in. long, 54 in. wide and 6 in. thick.

Any of these sets of dimensions may be used in finding the contents. The answer derived from the first set will be expressed in cubic yards, from the second set in cubic feet, and from the third set in cubic inches.

	a	b	c
	3 cu. yd.	9 cu. ft.	108 cu. in.
multiplied by	1½	4½	54
	4½ cu. yd.	40½ cu. ft.	432
			540
			5832 cu. in.
multiplied by	⅙	½	6
	¾ cu. yd.	20¼ cu. ft.	34992 cu. in.

Written Exercises

1 Find the contents of a 10 ft. cube.

2 Find the contents of a rectangular solid measuring 3 ft by 8 ft. by 14 ft. 6 in.

3 How many cubic inches in a block 8½ in. long, 3¼ in. wide and 2⅝ in. high?

4 Find the contents of a tank 18 ft. long, 6 ft. wide, and 3 ft. 7 in. deep.

5 How many bushels of potatoes can be put in a bin 6 ft. long, 4 ft. wide and 3 ft. deep?

6 How many gallons of water will a tank hold that is 8 ft. long, 2 ft. 4 in. wide and 2 ft. 4 in. deep?

7 How many cubic feet in a pile of four-foot wood, 8 ft. long and 6 ft. high?

8 Find the contents of a box 4 in. by 6 in. by 8 in.

9 How many 1 inch cubes can be packed in a drawer 2⅓ ft. long, 1 ft. 8 in. wide, and 4 in. deep?

10 How many cubic feet of air in a school room 32 ft. long 24 ft. wide and 12 ft. high?

11 How many cubic feet of masonry in a stone wall 120 ft. long, 3 ft. high and 18 in. thick?

12 How many cubic feet in the walls of a cellar 30 ft. long and 27 ft. wide, the walls being 7 ft. high and 18 in. thick?

(A sketch of the plan of the cellar will prevent reckoning the corners twice.)

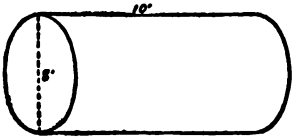
13 How many cubic yards in the walls of a cellar 39 ft. long and 33 ft. wide, the wall being 8 ft. high and 2 ft. thick?

14 How many square yards will there be in a sidewalk 4 ft. wide, extending around the inside of a park 325 ft. long and 240 ft. wide? (Make a sketch of park and walk.)

15 How many square yards in the sidewalk extending around the outside of the above mentioned park?

The Cylinder

To find the contents of a cylinder whose diameter is 8 feet and whose height in length is 10 feet.



$$\begin{array}{lrrr} \text{The area of one end} = & 2\overline{)8} & 4 & 3.1416 \\ & 4 & \underline{\times 4} & \underline{\times 16} \\ & & 16 & 188496 \\ & & & \underline{31416} \\ & & & 50.2656 \text{ sq. ft.} \end{array}$$

Then 1 foot of the length = 50.2656 cu. ft.
10 feet of the length = 10 times 50.2656 cu. ft. or
502.656 cu. ft., Ans

Written Exercises

1 Find the number of cubic inches in a glass whose height is 4 in. and whose diameter is 3 in.

2 How many cubic feet in an iron barrel whose diameter is 2 ft. and depth 3 ft.?

3 A tank 18 in. in diameter and 5 ft. high will hold how many gallons of water? (231 cu. in. = 1 gal.)

4 How many gallons of water in a tank 3 ft. in diameter and 7 ft. high, the tank being only half filled?

5 How many times can a measure 3 in. in diameter and 5 in. in height be filled from a can holding 10 gallons?

6 How many cubic feet of difference is there between a 3 foot cubical box and a cylinder 18 in. in radius and 3 ft. in depth?

7 How many cubic feet of difference is there between two 10 foot pipes, one being 1 in. in diameter and the other 2 in. in diameter?

8 How many pails of water will be needed to fill a tank, the pail being 10 in. deep, and 6 in. in diameter, while the tank is 2 ft. deep and 2 ft. in radius?

9 How many cubic inches in a 6-inch stove pipe 10 ft. long?

10 Which is the better bargain for the same amount of money, a 5 in. cubical box of berries or a cylindrical measure 7 in. high and 4 in. in diameter?

MEASUREMENTS—BOARDS AND LUMBER

A board foot is a piece of lumber a foot square and one inch thick.

To find the number of board feet in a two by four joist 18 feet long.

In a piece of lumber

1 in. thick, 1 ft. wide and 18 ft. long there are 18 bd. ft
1 in. thick, ⅓ ft. wide and 18 ft. long there are 6 bd. ft
2 in. thick, ⅓ ft. wide and 18 ft. long there are 12 bd. ft

or

18 bd. ft.
multiplied by ⅓
6 bd. ft.
multiplied by 2
12 bd. ft., Ans.

(All thicknesses less than 1 inch are ordinarily reckoned as 1 inch.)

Written Exercises

1 Find the number of board feet in a timber 16 ft. long, 1 ft wide and 4 in. thick.

2 How many board feet in 5 planks 18 ft. long, 6 in. wide and 2 in. thick?

3 How many board feet in 10 timbers 12 ft. long, 9 in. wide and 6 in. thick?

4 Find the number of board feet in a stick of timber 20 ft long and 8 in. square.

5 How much lumber in a load of 158 joists, each of which is 12 ft. long and 2 in. by 4 in. at the end?

6 How much lumber will be required to make 1 inch covers for 3 boxes, each of which is 3 ft. long and 2 ft. 6 in. wide, the boards being 10 in. wide?

7 Find the amount of inch boards required to cover a two-slant roof, the length being 48 ft. and the slant height being 30 ft.

8 How many boards 8 in. wide and 1 in. thick can be sawed from a log that squares 10 in. allowing $\frac{2}{7}$ in. for the cut of the saw?

9 Find the cost of boarding a tight fence around an acre lot which measures 40 rd. long and 4 rd. wide, the fence being 5 ft high and the boards costing $20 per thousand.

10 If a thousand shingles will cover one square, how much will it cost to shingle a roof 45 ft. long and 28 ft. slant at $0.75 per bunch? (1 square; 100 sq. ft. 1 M = 4 bunches.)

MEASUREMENTS—WOOD

Wood is usually cut four feet in length and sold by the cord which is 128 cubic feet. A cord foot is $\frac{1}{8}$ of a cord, or 16 cubic feet

To find the number of cords in a pile of four-foot wood which is 108 feet long and which averages 6 feet in height.

$$\begin{array}{lr} & 108 \text{ cu. ft.} \\ & \underline{\times 6} \quad\quad\; \\ & 648 \text{ cu. ft.} \\ & \underline{\times 4} \quad\quad\; \\ \text{The number of cu. ft.} & 2592 \text{ cu. ft.} \end{array}$$

$$\begin{array}{ll} & \,20\tfrac{1}{4} \\ \text{Dividing by 128 cu. ft.} & 128\overline{)2592} \\ & \underline{256} \\ & \frac{32}{128}=\frac{1}{4} \end{array}$$

20¼ cds., Ans.

Written Exercises

1 How much is a pile of cord wood 40 ft. long and averaging 6 ft. in height worth at $5.25 per cord?

2 How many cords of wood can be stored in a shed 16 ft. square and 8 ft. high?

3 If the dray is 12 ft. long, how high must the load of 4 ft. wood be piled that it may contain 1 cord?

4 How many cords in a pile of wood that measures 80 ft. by 6 ft. by 4 ft.?

5 Find the cost of a pile of wood 16 ft. long, 10 ft. wide and 9 ft. high at $6.00 per cord.

MEASUREMENTS—TANKS, CISTERNS AND BINS

One bushel equals 2150.4 cu. in.
One gallon equals 231 cu. in.
One cubic foot of water weighs 62½ pounds.

(For the weights of different grains, see the tables at the beginning of this book.)

To find how many bushels a bin 8 feet long, 6 feet wide, and 4 feet deep will hold.

8 cu. ft.
×6
48 cu. ft.
×4
Number of cubic feet 192 cu. ft.

1728 cu. in.
×192
3456
15552
1728
331776 cu. in.

Dividing by the number of cu. in. in one bushel

$$\begin{array}{r} 154\frac{2}{7} \\ 2150.4\overline{)33\ 1776.0} \\ 21\ 504 \\ \hline 11\ 6736 \\ 10\ 7520 \\ \hline 9\ 2160 \\ 8\ 6016 \\ \hline \frac{6144}{21504} = \frac{2}{7} \end{array}$$

154$\frac{2}{7}$ bu., Ans.

Written Exercises

1 How many bushels will a bin 12 ft. long, 7 ft. wide, and 4. ft. deep hold?

2 How many bushels will a bin 6 ft. long, 2 yd. wide, and 50 in. deep hold?

3 How many bushels of corn can be put into a bin 8 ft. 5 in. long, 5 ft. 4 in. wide, and 3½ ft. deep?

4 How many gallons is the capacity of a rectangular tank 4 ft. 5 in. long, 3 ft. 1 in. wide and 2 ft. 6 in. deep?

5 How many gallons of water can be put into a rectangular tank 10 ft. 6 in. long, 7 ft. 9 in. wide, and 4 ft. 1½ in. deep?

6 What is the weight of the water in the tank described in Example 4.

7 What is the weight of the water in the tank described in Example 5.

8 Find the capacity of a tank 15 in. long, 12 in. wide, and 10 in. deep.

9 How many pounds of water will the above-described tank hold?

10 What is the weight of the wheat that can be put into a bin 20 ft. long, 16 ft. 3 in. wide, and 8 ft. 2 in. deep?

PERCENTAGE

As $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, or $\frac{5}{5}$ of anything represents the whole of it, so 100% of anything represents the whole of it, as 100% means $\frac{100}{100}$. 100% of $500 is $500; 100% of 30 bushels is 30 bushels.

Since 100% = the whole
50% = $\frac{50}{100}$ or $\frac{1}{2}$ of the whole
25% = $\frac{25}{100}$ or $\frac{1}{4}$ of the whole
10% = $\frac{10}{100}$ or $\frac{1}{10}$ of the whole
5% = $\frac{5}{100}$ or $\frac{1}{20}$ of the whole
4% = $\frac{4}{100}$ or $\frac{1}{25}$ of the whole
12½% = $\frac{12\frac{1}{2}}{100}$ or $\frac{1}{8}$ of the whole
33⅓% = $\frac{33\frac{1}{3}}{100}$ or $\frac{1}{3}$ of the whole
37½% = $\frac{37\frac{1}{2}}{100}$ or $\frac{3}{8}$ of the whole
40% = $\frac{40}{100}$ or $\frac{2}{5}$ of the whole
60% = $\frac{60}{100}$ or $\frac{3}{5}$ of the whole
62½% = $\frac{62\frac{1}{2}}{100}$ or $\frac{5}{8}$ of the whole
66⅔% = $\frac{66\frac{2}{3}}{100}$ or $\frac{2}{3}$ of the whole
75% = $\frac{75}{100}$ or $\frac{3}{4}$ of the whole
80% = $\frac{80}{100}$ or $\frac{4}{5}$ of the whole
87½% = $\frac{87\frac{1}{2}}{100}$ or $\frac{7}{8}$ of the whole
1% = $\frac{1}{100}$ of the whole
2% = $\frac{2}{100}$ of the whole
3% = $\frac{3}{100}$ of the whole
6% = $\frac{6}{100}$ of the whole
7% = $\frac{7}{100}$ of the whole
8% = $\frac{8}{100}$ of the whole

$14\% = \frac{14}{100}$ of the whole

$26\frac{1}{2}\% = \frac{26\frac{1}{2}}{100}$ of the whole

$83\% = \frac{83}{100}$ of the whole

It is often shorter to find a percentage of a number by using the aliquot part as indicated in the foregoing table, (see Process I in the following problem), but the correct answer can always be secured by using the number of hundredths represented by the given rate. (See Process II in the following problems.)

Illustrations:

I. To find 50% of $300.

Process I. 50% is $\frac{1}{2}$

$\frac{1}{2}$ of \$300 = \$150, Ans.

Process II. $50\% = \frac{50}{100}$

$\frac{1}{100}$ of \$300 = \$3

$\frac{50}{100}$ of \$300 = 50 times \$3 or \$150, Ans.

II. To find 43% of $800.

$43\% = \frac{43}{100}$

$\frac{1}{100}$ of \$800 = \$8

$\frac{43}{100}$ of \$800 = 43 times \$8 = \$344, Ans.

III. To find 87½% of $536.40.

$87\frac{1}{2}\% = \frac{7}{8}$

$\frac{1}{8}$ of \$536.40 = \$67.05

$\frac{7}{8}$ of \$536.40 = 7 times \$67.05 = \$469.35, Ans

or $87\frac{1}{2}\% = \frac{87\frac{1}{2}}{100}$

$\frac{1}{100}$ of \$536.40 = \$5.364

$\frac{87\frac{1}{2}}{100}$ of \$536.40 = 87½ times \$5.364 = \$469.35, Ans.

Oral Exercises

1 Find 25% of 200.
2 Find 33⅓% of 150.
3 Find 50% of 400.
4 Find 20% of 300.
5 Find 10% of 160.
6 Find 60% of 50.
7 Find 75% of 48.
8 Find 40% of 120.
9 Find 80% of 80.
10 Find 30% of 912.
11 Find 18% of 300.
12 Find 45% of 250.
13 Find 125% of 320.
14 Find 200% of 750.
15 Find 150% of 180.
16 Find 500% of 45.
17 Find 66⅔% of 75.
18 Find 12½% of 96.
19 Find 62½% of 64.
20 Find 87½% of 16.

Written Exercises

1 Find 65% of 132.
2 Find 43% of 67.
3 Find 173% of 425.
4 Find 93% of 175.
5 Find 85% of 340.
6 Find 66⅔% of 1976.
7 Find 28% of 371.
8 Find 93% of 43.
9 Find 112% of 760.
10 Find 14% of 185.
11 Find 63% of 1765.
12 Find 175% of 476.
13 Find 38% of 317.
14 Find 99% of 200.
15 Find 100% of 1636
16 Find 163% of 415.
17 Find 39% of 14.
18 Find 61% of 9.
19 Find 536% of 32.
20 Find 161% of 14.

21 A man owning 137 acres of land sold 63% of it. How many acres did he sell?

22 15% of the pupils of school were absent. Of 120, the number belonging, how many were present?

23 26% of a carload of potatoes spoiled. Of the original consignment of 720 bushels, how many bushels spoiled?

24 A business man gained in one year a sum equal to 17% of his investment of $12130. How much money did he then have?

25 Mr. Harris saves each year 32% of his salary of $2500. What amount does he save each year?

26 Mr. Jones owes $4176 and is able to pay 63% of that amount. How much remains unpaid?

27 Of a consignment of 1035 tons of coal, 38% will be needed to fill immediate orders. How many tons will be left?

28 $\frac{1}{4}\%$ of 636 + 25% of 148 − $\frac{1}{3}\%$ of 3600 + $\frac{1}{3}$ of 120 = ?

29 Which is greater and how much, 43% of $372 or 16% of $1338?

30 Of a garrison of 840 men, $6\frac{2}{3}\%$ are sick. How many men are not sick?

PERCENTAGE—RATE

Illustrations:

I. Five dollars is what per cent of ten dollars?

Five dollars is $\frac{5}{10}$ or $\frac{1}{2}$ of ten dollars.

Since ten dollars is 100% of ten dollars, five dollars is $\frac{1}{2}$ of 100% or 50% of ten dollars, Ans.

II. Six bushels is what per cent of 543 bushels?

6 bu. = $\frac{6}{543}$ or $\frac{2}{181}$ of 543 bu.

Since 543 bu. is 100% of 543 bu., 6 bu. is $\frac{2}{181}$ of 100% or $\frac{200}{181}\% = 1\frac{19}{181}\%$ of 543 bushels, Ans.

III. 450 rd. is what per cent of 400 rd?

450 rd. = $\frac{450}{400}$ or $\frac{9}{8}$ of 400 rd.

Since 400 rd. = 100% of 400 rd., 450 rd. = $\frac{9}{8}$ of 100% or $\frac{900}{8}\% = 112\frac{1}{2}\%$ of 400 rd., Ans.

Oral Exercises

1 16 is what per cent of 64?
2 25 is what per cent of 125?
3 14 is what per cent of 42?
4 38 is what per cent of 42?
5 6 is what per cent of 16?
6 21 is what per cent of 35?
7 40 is what per cent of 60?
8 63 is what per cent of 70?
9 56 is what per cent of 64?
10 18 is what per cent of 72?
11 What % of .025 is .05?
12 What % is 80 of 96?
13 What % of 90 is 60?
14 What % of 250 is 200?
15 What % is 36 of 24?
16 What % is 24 of 36?
17 What % is 120 of 180?
18 What % is $1\frac{3}{4}$ of $2\frac{1}{2}$?
19 What % is 3 bu. of 2 pk?
20 What % is 72 of 45?

Written Exercises

1 432 bu. is what % of 675 bu.?
2 42 is what per cent of 350?
3 3.85 is what % of 19.25?

4 9.33 is what % of 24.88?

5 637 is what % of 910?

6 What % of $1287 is $193.05?

7 What % of 4 bu., 2 pk., 6 qt. is $\frac{5}{8}$ pk.?

8 What % of $\frac{12}{25}$ is $\frac{8}{125}$?

9 What % of 434 is 119?

10 What % of .00375 is .525?

11 In a school of 425 pupils, 35 were absent. What % were present?

12 If a miller keeps 5 quarts out of every 4 bushels as his pay. what is his rate of charge?

13 Berries costing $6.40 for 2 bushels, were sold for 12½¢ per quart. Find the rate of gain.

14 By selling for $531 a horse that cost $360, what per cent was gained?

15 Out of an army of 36,000 men, 4175 were lost. Find per cent of loss.

16 Of 675 men at work, 45 were discharged. What per cent were retained?

17 After travelling 83⅓ miles of a journey of 112½ miles what per cent remains to be travelled?

18 Of $840 in the bank, $370 was drawn out. What per cent was drawn out?

19 A man spent $\frac{13}{25}$ of $1765. What per cent remained unexpended?

20 By selling a house for $2750, $750 was lost. What per cent would have been gained by selling it for $4000?

PERCENTAGE—PRINCIPAL

The whole or 100% is sometimes called the principal or base.

Illustrations:

I. Thirty is 25% of what number?

25% = ¼.

30 is ¼ of 120 Ans

II. $\$54$ is 9% of what number of dollars?

$9\% = \frac{9}{100}$.

$\frac{9}{100}$ of the required number $= \frac{9}{100} = \$54$.

$\frac{1}{100}$ of the required number $= \$6$.

$\frac{100}{100}$ of the required number $= \$600$, Ans.

or

9% of the required number $= \$54$.

1% of the required number $= \$6$.

100% of the required number $= \$600$.

III. $\$75$ is $33\frac{1}{3}\%$ of what number?

$33\frac{1}{3}\% = \frac{33\frac{1}{3}}{100}$

$33\frac{1}{3}\%$ of the required number $= \$75$.

$\frac{33\frac{1}{3}}{100}$ of the required number $= \$75$.

$\frac{1}{100}$ of the required number $= \frac{1}{33\frac{1}{3}}$ of $\$75 = \$2.2388$.

$\frac{100}{100}$ of the required number $= 100$ times $\$2.2388 = \$223.88$ Ans.

Oral Exercises

1 35 is 5% of what number?
2 72 is 6% of what number?
3 45 is 50% of what number?
4 36 is $33\frac{1}{3}\%$ of what number?
5 54 is $112\frac{1}{2}\%$ of what number?
6 320 is 10% of what number?
7 420 is 14% of what number?
8 .5 is 12.5% of what number?
9 10 is $6\frac{1}{4}\%$ of what number?
10 16 is $28\frac{4}{7}\%$ of what number?
11 225 is 75% of what number?
12 $18\frac{2}{11}$ is $9\frac{1}{11}\%$ of what number?
13 37 is 20% of what number?
14 45 is $62\frac{1}{2}\%$ of what number?
15 1000 is 250% of what number?

16 93 is 31% of what number?
17 50 is 16⅔% of what number?
18 350 is 175% of what number?
19 30 is 12% of what number?
20 420 is 60% of what number?

Written Exercises

1 A man spent 13% or $1217.06 of his money. How much had he at the beginning?

2 A regiment lost 236 men, which was 19⅔% of its whole number. Find its whole number.

3 With $1760 Mr. James paid 12½% of his debts. How much did he owe altogether?

4 The 31 absentees from a school were 3⅓% of what total membership?

5 $18.63 monthly expense is 18% of what annual income?

6 32⅞ bushels is 6¼% of what number of bushels?

7 A's saving, $357, is 43¾% of how large an income?

8 $1.33⅓ is ⅔% of the value of a piece of cloth. Find its full value.

9 In a certain shop 36 men were discharged. If this was 4.8% of the whole number employed, how many were not discharged?

10 What number increased by 45% of itself equals 52⅕?

PERCENTAGE—PROFIT AND LOSS

The cost price is 100%.

Illustrations:

I. For how much must a watch which cost $40 be sold that a profit of 20% may be realized?

100% = cost.
$40 = cost.
100% = $40.
20% = $8, profit.
$40 + $8 = $48, selling price, Ans.

or

100% = cost.
120% = selling price.
100% = $40.
1% = $0.40.
120% = 120 times $0.40 = $48.00, Ans.

or

20% = $\frac{1}{5}$.
$\frac{5}{5}$ = cost.
$\frac{6}{5}$ = selling price.
$\frac{5}{5}$ = $40.
$\frac{1}{5}$ = $8.
$\frac{6}{5}$ = $48, Ans.

II. A horse costing $300 is sold at a loss of $33\frac{1}{3}\%$. What is the selling price?

100% = cost.
$300 = cost.
100% = $300.
$33\frac{1}{3}\%$ = $100 loss.
$300 − $100 = $200, Ans.

or

100% = cost.
$66\frac{2}{3}\%$ = selling price.
100% = $300.
1% = $3.
$66\frac{2}{3}\%$ = $66\frac{2}{3}$ times $3 = $200, Ans.

or

$33\frac{1}{3}\%$ = $\frac{1}{3}$.
$\frac{3}{3}$ = cost.
$\frac{2}{3}$ = selling price.
$\frac{3}{3}$ = $300.
$\frac{1}{3}$ = $100.
$\frac{2}{3}$ = $200, Ans.

III. A watch sold for $36 at a gain of 20%. Find the cost.

100% = cost.
120% = selling price.
120% = $36.
1% = $\frac{1}{120}$ of $36 = $0.30.
100% = 100 times $0.30 = $30, Ans.

or

20% = $\frac{1}{5}$.
$\frac{5}{5}$ = cost.
$\frac{6}{5}$ = selling price.
$\frac{6}{5}$ = $36.
$\frac{1}{5}$ = $\frac{1}{6}$ of $36 = $6.
$\frac{5}{5}$ = 5 times $6 = $30, Ans.

IV. A horse sold for $150 at a loss of 25%. Find the cost.

100% = cost.
75% = selling price.
75% = $150.
1% = $2.
100% = $200, Ans.

or

25% = $\frac{1}{4}$
$\frac{4}{4}$ = cost
$\frac{3}{4}$ = selling price
$\frac{3}{4}$ = $150.
$\frac{1}{4}$ = $\frac{1}{3}$ of $150 = $50.
$\frac{4}{4}$ = 4 times $50 = $200, Ans.

V. A horse costing $120 was sold at a gain of $15. Find the per cent of profit.

100% = cost

$15 = [illegible] of the cost or [illegible] of 100% = [illegible]% = 12½%, Ans.

VI. A house was sold for $6000, which was a loss of $1200. Find the per cent of loss.

100% = cost

$6000 (S. P.) + $1200 (loss) = $7200 (cost).

$$\$1200 \text{ is } \tfrac{1200}{7200} \text{ of the cost or } \frac{\overset{\overset{50}{\cancel{100}}}{\cancel{1200}}}{\underset{\underset{3}{\cancel{6}}}{\cancel{7200}}} \text{ of } \cancel{100}\% = \tfrac{50}{3}\% = 16\tfrac{2}{3}\%, \text{ Ans.}$$

VII. A watch which cost $54 was sold for $60. Find the per cent of profit.

100% = cost

$60 (S. P.) − $54 (cost) = $6 (profit).

$$\$6 = \tfrac{6}{54} \text{ of the cost or } \frac{\overset{1}{\cancel{6}}}{\underset{9}{\cancel{54}}} \text{ of } 100\% = \tfrac{100}{9}\% = 11\tfrac{1}{9}\%, \text{ Ans.}$$

VIII. A man lost 2% by selling a piece of property for $125 below the cost. Find the cost.

$125 = $\tfrac{2}{100}$ of the cost.

$\tfrac{1}{100}$ of the cost = $\tfrac{1}{2}$ of $125 = $62½.

$\tfrac{100}{100}$ of the cost = 100 times $62½ = $6250, Ans.

IX. By selling a suit of clothes for $36, a dealer gained 12½% Find the cost.

100% = cost.

100% (cost) + 12½% (gain) = 112½% (S. P.).

$36 = 112½% of cost.

$$1\% \text{ of cost} = \frac{1}{112\frac{1}{2}} \text{ of } \$36 = \tfrac{2}{225} \text{ of } \$36 = \$0.32.$$

100% of cost = 100 × $0.32 = $32, Ans.

Written Exercises

1 Given cost $80, profit 20%. Find the selling price.

2 *Given cost $120,* profit 25%. Find the selling price.

3 *Given cost $75,* profit 33⅓%. Find the selling price.

4 Given cost $60, profit 15%. Find the selling price.

5 Given cost $40, loss 8%. Find the selling price.

6 Given cost $328, loss 12½%. Find the selling price.

7 Given cost $175, loss 9%. Find the selling price.

8 Given selling price $90, profit 10%. Find the cost.

9 Given selling price $147, profit 16⅔%. Find the cost.

10 Given selling price $391, profit 6¼%. Find the cost.

11 Given selling price $9,435, loss 15%. Find the cost.

12 Given selling price $28,248, loss 12%. Find the cost.

13 Given selling price $10,332, loss 16%. Find the cost.

14–26 Find the profit or loss in the foregoing examples: 1–13.

27 A house which cost $3000 was sold at a gain of 12%. Find the selling price.

28 I sold a watch which cost $60 at a loss of 10%. How much did I receive for it?

29 A horse which cost $75 was sold at a loss of 12½%. For how much was it sold?

30 By selling cloth at $4 a yard, I gain 8⅓%. Find the cost per yard.

31 A man bought real estate for $3424 and sold it so as to gain $428. What % profit did he make?

32 Goods bought for $623.52 were sold at a loss of $38.97 Find the % of loss.

33 I sold a canoe for $32, which was $7 more than it cost. What per cent did I make by the transaction?

34 A merchant sold a bill of goods for $176, losing $24. What per cent did he lose?

35 A man sold for $640 a pair of horses which cost him $800. Find the per cent of loss.

36 Bought eggs at 28¢ and sold them at 34¢ a dozen. What per cent was gained?

37 I sold a lot of land for $800 and gained 20%. Find the cost.

38 *By selling* a cow for $8 less than it cost, I lost 40%. Find *the cost.*

39 For how much must I sell a phonograph which cost **$30**, in order to gain 12½%?

40 If 3¢ represents a loss of 10% on a dozen eggs, what is the cost?

41 Find the per cent of gain if a desk costing **$36** is sold for $37.50.

PERCENTAGE—COMMISSION

Commission is a charge for service rendered, based upon the value of business done.

An agent who buys or sells goods for another often does so on a commission. The greater the value of the goods that he buys or sells, the greater his commission or pay. The higher the rate of commission, the larger his commission or pay.

The proceeds is the amount remaining after the commissions and other expenses have been paid.

Illustrations:

I. An agent sells produce valued at $100 at a commission of 5%. How much does said agent receive for his work? How much does the owner receive for the produce?

The agent does $100 worth of business for the owner.

5% of $100 = $5, amount received by the agent, Ans.

$100 − $5 = $95, amount received by the owner, Ans.

II. An agent in the south sells shoes to the value of $5000. After paying transportation charges of $56, storage charges of $18, and taking out his commission of 4%, how much is due the firm for whom he sells?

The agent does $5000 worth of business for the firm.

$5000 = 100%.

4% of $5000 = $200, the agent's commission.

$56 + $18 + $200 = $274, the total expense.

$5000 − $274 = $4726, the amount due the owner, Ans.

III. A buys $3000 worth of wool for B at a commission of 6½% How much does the wool cost B?

A does $3000 worth of business for B.

$3000 = 100%.

6½% of $3000 = $195, A's commission.

$3000 + $195 = $3195, Cost, Ans.

IV. Mr. Jones sends $5000 to his agent with which to buy hides after taking out his commission of 8%. How much is the agent's commission and how much is left with which to purchase hides?

(The agent does not do $5000 worth of business for Mr Jones.)

($5000 does not equal 100%.)

100% = Amount actually paid for hides.

8% = the agent's commission.

108% = amount sent, which is $5000.

1% = $\frac{1}{108}$ of $5000 = $46.2963.

8% = 8 times $46.2963 = $370.37, agent's commission, Ans

100% = 100 times $46.2963 = $4,629.63, Ans.

V. A merchant sends his agent $10,000 with which to buy corn after deducting his commission of 3½%. How many bushels can the agent buy at $0.50 per bushel?

(The agent does not do $10,000 worth of business for the merchant.)

($10,000 does not equal 100%.)

100% = amount actually paid for corn.

3½% = the agent's commission.

103½% = amount sent, which is $10,000.

1% = $\frac{1}{103\frac{1}{2}}$ of $10,000 = $96.6184.

100% = 100 times $96.6184 = $9661.84, amount paid for corn, Ans.

$9661.84 ÷ $0.50 = 19323.68 times. 19323.68 bu., Ans.

VI. An agent receives $5 commission for selling $250 worth of goods for his firm. Find his rate of commission.

100% = $250, value of business done for firm.

Commission is $\frac{\cancel{5}}{\underset{\cancel{50}}{\cancel{250}}}$ of $\overset{2}{\cancel{100}}\% = 2\%$, Ans.

VII. After paying a commission of 2½% and other expenses of $50, $9700 was found to be the net proceeds of a sale. Find the amount of the sale.

100% = amount of sale.
2½% = rate of commission.
$9700 + $50 = whole of sale price, except commission.
$9750 = 97½% of sale price.
$100 = 1% of sale price.
$10000 = 100% of sale price. $10,000, Ans.

Written Exercises

1 A merchant's commission is 2% on a sale of $402. Find the amount of his commission.

2 Find the commission upon 5000 bales of cotton, sold at $30 per bale, the commission rate being 5%.

3 A dealer's sale of 20 horses at $100 each gave him how much commission at the rate of 2%?

4 An agent sold $5600 worth of wool for his firm. What was the net amount received by the firm after payment of the agent's commission of 4%?

5 An auctioneer, whose terms are 5%, sells 85 yd. of carpet at $1.50; 70 yd. at $1.00; 1 rug at $46.50; 3 pairs of lace curtains at $4.98. What is the amount of his commission?

6 My agent buys for me 300 bushels of potatoes at 65¢ per bushel, his commission being 3%. How much do the potatoes cost me?

7 An agent sold a cargo of goods on a commission of 1½% and sent the cwner $9,357.50. Find his commission.

8 Received $5,737.50 to invest after deducting my commission of 2%. How much did I invest?

9 The net proceeds of a sale being $17,472.25, after paying commission of 3½% and other expenses of $283.75, find the amount of sale.

10 An agent's commission at the rate of 5% was $63.50. Find the amount of the sale.

11 An agent received $6,727.50 with which to buy flour at $5 per barrel, after deducting his commission of 3½%. How many barrels did he buy?

12 An agent sold property for $43,520, and sent the owner $42,540.80 after retaining his commission of how many per cent?

13 On 60% of a bill of $320, the collector's commission at the rate of 2½% would be how much?

14 I sent $19,950 to my agent to invest, after deducting his commission of 5%. How much did he invest?

15 An agent sold goods for $9,792 on a commission of 4% and invested the net proceeds in other goods, after reserving a commission of 2%. What was his entire commission?

PERCENTAGE—COMMERCIAL DISCOUNT

Many classes of merchandise are listed at prices above what the owner expects to receive and in excess of any probable advance of the market price. The merchandise is then sold at a discount that is in keeping with the market price and the changes in cost.

Discounts are sometimes given for special reasons, such as cash, cash in ten days, etc.

Illustrations:

I. The list price of a piece of furniture was $18, but the dealer allowed a discount of 20%. What was the actual cost to the purchaser?

20% of $18 = $3.60 discount.

$18 − $3.60 = $14.40, Ans.

II. Mr. Balch paid \$27 for a carpet after a discount of 25%. What was the list price?

100% = list price.
100% − 25% = 75%, selling price.
\$27 = selling price.
75% of the cost = \$27.
$\frac{3}{4}$ of the cost = \$27.
$\frac{1}{4}$ of the cost = $\frac{1}{3}$ of \$27 = \$9.
$\frac{4}{4}$ of the cost = 4 times \$9 = \$36, Ans.
or
75% of the cost = \$27.
$\frac{75}{100}$ of the cost = \$27.
$\frac{1}{100}$ of the cost = $\frac{1}{75}$ of \$27 = \$27 ÷ 75.
$\frac{100}{100}$ of the cost = $\frac{100}{75}$ of \$27 = \$27 ÷ $\frac{75}{100}$.
\$27 ÷ $\frac{75}{100}$ = \$27 ÷ .75 = \$36, Ans.

Note: When successive discounts are allowed, each must be computed separately.

III. Find the actual selling price of goods marked at \$60 and sold at $33\frac{1}{3}\%$, $12\frac{1}{2}\%$ and 10% off.

First discount	$33\frac{1}{3}\%$ of \$60 = \$20. \$60 − \$20 = \$40.
Second discount	$12\frac{1}{2}\%$ of \$40 = \$5. \$40 − \$5 = \$35.
Third discount	10% of \$35 = \$3.50. \$35 − \$3.50 = \$31.50, Ans.

IV. Mr. Jones paid \$1000 for goods after discounts of 50% and 20% had been allowed. What was the list price?

Second discount	= 20%. 100% − 20% = 80%. 80% = \$1,000. 1% = $\frac{1}{80}$ of \$1 000 = \$12.50. 100% = 100 times \$12.50 = \$1,250.
First discount	= 50%. 100% − 50% = 50%. 50% = \$1,250. 1% = $\frac{1}{50}$ of \$1,250 = \$25. 100% = 100 times \$25 = \$2,500, Ans.

Written Exercises

1 Given list price $40, discount 10%. Find the selling price.

2 Given list price $297, discount 33⅓%. Find the selling price.

3 Given list price $328, discount 12½%. Find the selling price.

4 Given list price $125, discount 40%. Find the selling price.

5 Given list price $62.50, discount 25%. Find the selling price.

6 Given selling price $216.48, discount 30%. Find list price.

7 Given selling price $3,512, discount 5%. Find list price.

8 Given selling price $48.72, discount 20%. Find list price.

9 Given selling price $121.33, discount 8⅓%. Find list price.

10 Given selling price $727.60, discount 15%. Find list price.

11 Find the selling price of goods marked at $30, with successive discounts of 10%, 5% and 2%.

12 Of goods marked at $200, with discounts of 25%, 10% and 5%.

13 Of goods marked at $324, with discounts of 20%, 12% and 8%.

14 Of goods marked at $75, with discounts of 33⅓%, 15% and 5%.

15 Of goods marked at $164, with discounts of 40%, 20% and 10%.

16 Find the list price of goods sold for $600, after deducting successive discounts of 20%, 8% and 5%.

17 Of goods sold at $80, after successive discounts of 5%, 3% and 1%.

18 Of goods sold at $62.50, after successive discounts of 8%, 4% and 2%.

19 Of goods sold at $125, after successive discounts of 30%, 15% and 5%.

20 Of goods sold at $9.75, after successive discounts of 33⅓%, 20% and 10%.

21 Find the list price of goods which sold for $17.50, after deducting a discount of 12% for cash.

22 At what price must good be marked so that a discount of *10% may be allowed*, and $2.79 received for the goods?

23 I bought a refrigerator marked $32 at a discount of 20%. What did I pay for it?

24 A merchant bought goods of a wholesale firm amounting to $312.75 and was allowed discounts of 12%, 5%, and 3%. Find the amount of a check which would pay for the goods.

25 Mr. Jones gave a check for $425 for merchandise on which he had been allowed successive discounts of 10%, 5% and 3%. What was the list price of the goods?

PERCENTAGE—INSURANCE

The policy is the written or printed contract between the insurer and the insured.

The Face of the Policy is the amount for which the property is insured.

The Premium is the amount paid for the insurance,—it is equal to that part of the face of the policy which is represented by the rate.

Illustrations:

I. Property is insured for $7,000 at $\frac{1}{6}$%. Find the premium.

1% of $7,000 = $70.
$\frac{1}{6}$% of $7,000 = $\frac{1}{6}$ of $70 = $11.67, Ans.

II. $800 is paid for insuring property at $\frac{1}{4}$%. Find the face of the policy.

$\frac{1}{4}$% of the face of the policy = $800.
1% of the face of the policy = $3,200.
100% of the face of the policy = $320,000, Ans.

III. When $65 is paid for insuring property for $13,000, what is the rate of insurance?

$13,000 = 100% or the face of the policy.
$65 is $\frac{65}{13000}$ of $13,000.
$\frac{65}{13000}$ of 100% = $\frac{6500}{13000}$% = $\frac{1}{2}$%, Ans.

IV. A house valued at $15,000 is insured for $\frac{4}{5}$ of its value at 1$\frac{1}{2}$%. Find the premium.

$\frac{4}{5}$ of $15,000 = $12,000.
1$\frac{1}{2}$% of $12,000 = $180, Ans.

Written Exercises

1 A house worth $15,000 is insured at ⅛%. Find the premium.

2 Property worth $12,750 is insured for ⅔ of its value at 1⅛%. Find the premium.

3 If the premium on a $11,040 house, insured for ⅔ of its value is $184, what is the rate of insurance?

4 A house worth $18,720 is insured for ¾ of its value at 2% Find the loss to the owner in case of its total destruction.

5 $75 is the premium at 3% on how large a policy?

6 A house worth $7,200 is insured for ⅘ of its value and furniture worth $1,800 is insured for ⅔ of its value, the insurance rate in both cases being ¾%. The property is entirely destroyed. Find the owner's loss.

7 $96 is the premium at ¾% on a house insured for ⅘ of what value?

8 $223.50 will insure what value of property at the rate of 3½%?

9 What is the rate of insurance when the premium on a $8,400 policy is $112?

10 A man invested 36% of his money in a house worth $10,800, which he insured for ⅘ of its value at ¾%. How much money had he left after the total destruction of the house?

PERCENTAGE—DUTIES AND CUSTOMS

Duties and Customs are payments demanded and collected by the government for the importation of merchandise.

Specific duties are those which state that so much shall be paid per unit of measurement or weight.

Iron or steel hinges, 1½¢ per lb.
Potatoes and apples, 25¢ per bu.
Mackerel, salmon and halibut, 1¢ per lb.
Molasses, testing above 40° and not above 56°, 3¢ per gal.
Molasses testing above 56°, 6¢ per gal.
Sugar, lowest grade, $\frac{95}{100}$¢ per lb.
Sugar, *highest* grade, 1$\frac{95}{100}$¢ per lb.
Hay, $4.00 per ton.

Sawed lumber, $2.00 per thousand
Liquors, $2.25 per gal.
Wine in casks, 50¢ per gal.
Wine bottled, one doz. to the case, $1.60 per case.

Ad valorem duties are those in which a certain percentage of the value is paid.

China ware	60%	Silk wearing apparel	60%
Embroidery	60%	Molasses testing under 40°	20%
Furniture	35%	Manufactures of metal	45%

Manufactures of wood, 35%.
Manufactures of cotton, linen, flax, jute, 45%.

Paintings and statuary from Italy, France, Germany, Portugal, by Reciprocity Treaty, 15%.

Some articles are subject to both an ad valorem duty and a specific duty.

Agate buttons $\frac{1}{12}$¢ per line per gross and 15%.
(1 line $= \frac{1}{40}$ inch used in measuring diameter of buttons.)
Woolen cloth, 44¢ per lb. and 60%.
Cotton hosiery, 50¢ per doz. and 15%.

NOTE: The rate on many articles depends upon the quality, and several rates are established for one general class of goods; for example, the specific rate on cotton hosiery may be as high at $2.00 per dozen, and the rate on gloves varies from $1.75 to $5.00 per dozen with extra duties for embroidery and number of buttons.

Illustrations:

I. Find the duty on 285,600 feet of sawed lumber.

285,600 feet = 285.6 thousand.
285.6 times $2.00 = $571.20, Ans.

II. Find the duty on 35 sets table dishes valued at $34.00 per set.

35 times $34 = $1190.
60% of $1190 = $714, Ans.

III. Find the duty on 10,100 gross agate buttons measuring 22 lines and costing 8¢ per gross.

10,100 times 8¢ = $808, Cost.
15% of $808 = $121.20.
22 times $\frac{1}{12}$¢ $= \frac{11}{6}$¢.
10,100 times $\frac{11}{6}$¢ = $185.17.
$121.20 + $185.17 = $306.37, Ans

Written Exercises

Find the duty in the following cases:

1 On 3,000 bu. potatoes.

2 On 148 tons of hay.

3 On 18 casks of wine, each containing 15 gal.

4 On 3½ ton halibut.

5 On 750 lb. iron hinges

6 On 11 silk dresses valued at $125.00 each.

7 On $675 worth of furniture.

8 On 12 dinner sets valued at $18.50 a set.

9 On 320 yd. cotton cloth at 6¢ a yd.

10 On embroidery valued at $975.

11 On 67,400 ft. sawed lumber.

12 On 426 lb. woolen dress goods at 87½¢ a lb.

13 On 6,125 gross agate buttons, measuring ½ inch in diameter at 6¢ per gross.

14 On 157 chests of tea, each containing 60 lb. at 45¢ a lb at 25% ad valorem.

15 On 30 watches at $150 each, the duty being 25% ad valorem

PERCENTAGE—TAXES

Taxes are computed upon the total valuation of an individual's real estate and personal property. To the property tax there is often added a poll tax which is usually either two or three dollars.

The rate of property taxation is generally given as so many dollars on a thousand dollars of valuation.

Illustrations:

I. Mr. Smith's personal property is assessed for $8,000.00, his real estate is assessed for $4,000.00, and he pays one poll tax of $2.00. The tax rate in Mr. Smith's town is $14.10. Find the amount of his tax bill.

$8,000.00 + $4,000.00 = $12,000.00.
$12,000.00 = 12 thousand dollars.
12 times $14.10 = $169.20, property tax.
$169.20 + $2.00 = $171.20, total tax, Ans.

II. A tax of $125.00 was paid on a piece of property, the rate being $12.50. Find the valuation of the property.

$12.50 = tax on one thousand dollars.
$125.00 ÷ $12.50 = 10 times.
Therefore $125.00 = tax on ten thousand dollars.
$10,000, Ans.

III. When a tax of $180.00 is paid on property assessed for $15,000.00, what is the tax rate per thousand? Per hundred? Per dollar?

$15,000.00 = 15 thousand dollars.
$180.00 ÷ 15 = $12.00.

$$\left.\begin{array}{l}\$12.00 \text{ on a thousand.}\\ \$1.20 \text{ on a hundred}\\ \$0.012 \text{ on a dollar}\end{array}\right\} \text{Ans.}$$

Written Exercises

Find the amount of the tax bill in each of the following cases:

1 Personal property $2,000; real estate $6,000; rate $12.70; one poll tax of $2.00.

2 Personal property $1,275; real estate $3,000; rate $10.40; one poll tax of $2.00.

3 Personal property $15,000; real estate $12,500; rate $18.60; one poll tax of $2.00.

4 Personal property $7,250; real estate $4,300; rate $13.50; one poll tax of $2.00.

5 Personal property $675; real estate $2,500; rate $16.20; one poll tax of $2.00.

6 Personal property $2,300; real estate $5,600; rate $14.80; one poll tax of $2.00.

7 What is the tax on a piece of property valued at $4,750, taxed on ¾ of the valuation, at $10.70 on a thousand?

Find the valuation in the following cases:

8 Tax bill $62.54; rate $14.75.
9 Tax bill $50.40; rate $11.20.
10 Tax bill $118.56; rate $15.60.
11 *Tax bill $47.88*; rate $17.10.
12 *Tax bill $67.58*; rate $13.25.

Find the tax rate per thousand in the following cases:

13 Tax bill $80.00, valuation $6,400.

14 Tax bill $82.36, valuation $5,800.

15 Tax bill $247.95, valuation $14,500.

PERCENTAGE—STOCKS AND BONDS

Unless otherwise stated, the par value of a share of stock is $100.

When bought or sold at a premium, a share is bought and sold for more than $100.

When bought or sold at a discount, a share is bought or sold for less than $100.

Brokerage is a commission charged by the broker for buying or selling stock. Brokerage increases the cost to the one for whom the broker buys, and decreases the proceeds for the one for whom the broker sells. Brokerage is always computed on the par value.

"U. S. 6s at 108" means that these United States bonds are valued at $108 per $100 share, and that they are paying dividends of 6% of the **par value** each year.

The dividend on a share of the above is $6 each year. The share costs $108; hence less than 6% is realized. The dividend is $\frac{6}{108}$ of the investment each year, or $\frac{6}{108}$ of 100%, which is $5\frac{5}{9}$%.

Illustrations:

I. Find the cost of 14 shares of railroad stock bought at $85, brokerage $\frac{1}{4}$%.

Each share cost $$85\frac{1}{4}$.

14 times $$85\frac{1}{4}$ = $1,193.50, Ans.

II. Find the cost of 40 U. S. bonds, bought at 10% premium, brokerage being $\frac{1}{8}$%.

$100 = par value.
10% premium = $10 premium.
$110 = value per share.
$$110\frac{1}{8}$ = cost per share including brokerage.
40 times $$110\frac{1}{8}$ = $4 405, Ans.

III. Find the amount received for 80 shares of mining stock which was sold at 12% discount, brokerage being $\frac{1}{4}$%.

$100 = par value.
12% discount = $12 discount.
$88 = value per share.
$88 − $$\frac{1}{4}$ = 87\frac{3}{4}$, proceeds of one share.
80 times 87\frac{3}{4}$ = $7,020, Ans.

IV. When stock is bought at 82 and sold at 102, what is the gain on 20 shares?

$102 − $82 = $20, gain per share.
20 times $20 = $400, Ans.

V Which pay better, 6s at 109 or 4s at 80?

Each share of 4s pays $4 per year.
Each share of 6s pays $6 per year.
$6 = $\frac{6}{109}$ of $109.
$\frac{6}{109}$ of 100% = 5$\frac{55}{109}$%, rate paid by first.
4% = $\frac{4}{80}$ of $80.
$\frac{4}{80}$ of 100% = 5%, rate paid by the second.
6s at 109 pay a higher rate, Ans.

Written Exercises

1 Find the cost of 25 shares of N. Y., N. H. & H. R. R. at 197, brokerage $\frac{1}{8}$.

2 Find the cost of 16 Am. Tel. & Tel. Co. at 137$\frac{1}{2}$, brokerage $\frac{1}{8}$.

3 How much must I pay for 138 shares that are selling at a premium of 32%, brokerage being $\frac{1}{4}$?

4 How much do I gain on 186 shares of stock, which I buy at a discount of 4%, and sell at a premium of 5%, paying my broker $\frac{1}{4}$ for buying, and $\frac{1}{4}$ for selling?

5 What is the income upon 1836 Atchison 4s?

6 If my annual income upon Chi. & West Michigan 5s is $1350, how many shares do I own?

7 Which is the better investment, and how much better, *Chi. & West Michigan* 5s bought at 98 or Mexican Central 4s bought *at 78?*

8 How much must I pay for American Bell Tel. 4s at 98, brokerage ¼, that my annual income may be $1,164?

9 A man invested $40,150.50 in stock at 94, brokerage ¼. How many shares did he buy?

10 Bought 1,124 shares at 98 and sold them at 95, paying ¼ brokerage on each transaction. Find my loss.

11 If I invest $169,081 in Atchison 4s at 101, brokerage ⅛ what will be my annual income?

12 How much money must be invested in 8% stock at 121½, brokerage ⅛, to secure an income of $6,576?

13 If Mr. Stoddard sold 342 6% bonds at 96 and invested the proceeds in 7% bonds at 108, how much did he increase his income?

14 Mr. Hale sold 270 acres of land at $82.00 an acre and invested the proceeds in 4% stock at 90. What is his annual income?

15 Which is the better investment and how much better, $36,560 in 6% stock at 114, brokerage ¼, or the same amount in 3% stock at 57, brokerage ⅛?

SUBTRACTION OF DATES

I. Find the time between July 10, 1905 and Dec. 21, 1906

(a) From July 10, 1905 to July 10, 1906 = 1 yr.
(b) From July 10, 1906 to Dec. 10, 1906 = 5 mo.
(c) From Dec. 10, 1906 to Dec. 21, 1906 = 11 da.
1 yr. 5 mo. 11 da., Ans.

II. Find the time between Sept. 5, 1900 and Mar. 1, 1904.

(a) From Sept. 5, 1900 to Sept. 5, 1903 = 3 yr.
(b) From Sept. 5, 1903 to Feb. 5, 1904 = 5 mo.
(c) From Feb. 5, 1904 to Mar. 1, 1904 = 25 da.
3 yr. 5 mo. 25 da., Ans.

(Years divisible by 4 and not by 100; also years divisible by 400, are leap years, giving 29 days to February.)

Written Exercises

1 Find the time between Sept. 3, 1874 and Dec. 12, 1892.
2 Find the time between Oct. 14, 1876 and Nov. 30, 1879.
3 Find the time between Apr. 19, 1861 and July 4, 1876.
4 Find the time between May 31, 1895 and Jan. 1, 1904.
5 Find the time between Dec. 5, 1845 and Aug. 12, 1860.
6 Find the time between Sept. 12, 1789 and June 14, 1906.
7 Find the time between Dec. 20, 1620 and July 4, 1776.
8 Find the time between Feb. 22, 1732 and Dec. 14, 1799.
9 Find the time between June 7, 1893 and Jan. 1, 1905.
10 Find the time between Jan. 8, 1906 and May 1, 1906.

PERCENTAGE—INTEREST

Interest is money paid for the use of money.

The **principal** is the number of dollars for the use of which interest is paid.

The **rate** is the number of per cent for each year's use.

The **time** is the number of years, months, or days, for which interest is paid.

The **amount** is the sum of the principal and the interest.

SIMPLE INTEREST

In simple interest, a year is considered as 360 days and a month is considered as 30 days.

Illustrations:

Int. on $1.00 for 1 year at 6% = $0.06.
Int. on $1.00 for 2 mo. at 6% = $8\frac{1}{6}$ of $0.06 = $0.01.
Int. on $1.00 for 20 mo. at 6% = $0.10.
Int on $500.00 for 1 year at 6% = $30.00.
Int. on $500.00 for 2 mo. at 6% = $\frac{1}{6}$ of $30.00 = $5.00.
Int. on $500.00 for 20 mo. at 6% = $50.00.
Int. on $112.00 for 1 year at 6% = $6.72.
Int. on $112.00 for 2 mo. at 6% = $\frac{1}{6}$ of $6.72 = $1.12.
Int. on $112.00 for 20 mo. at 6% = $11.20.

Observe that in each case the interest for 20 mo. at 6% is $\frac{1}{10}$ of the principal. The interest on any principal for 20 mo. at 6% is $\frac{1}{10}$ of it. $\frac{1}{10}$ may be found most easily by moving the decimal point one place toward the left.

Written Exercises

1 Find the interest on $800.00 for 20 mo. at 6%.
2 Find the interest on $560.00 for 1 yr. 8 mo. at 6%.
3 Find the interest on $490.00 for 3 yr. 4 mo. at 6%.
4 Find the interest on $255.00 for 5 yr. at 6%.
5 Find the interest on $394.00 for 2 yr. 6 mo. at 6%
6 *Find* the interest on $685.00 for 4 yr. 2 mo. at 6%.

7 Find the interest on $295.00 for 2 yr. 1 mo. at 6%.
8 Find the interest on $436.00 for 2 yr. 11 mo. at 6%.
9 Find the interest on $434.65 for 3 yr. 9 mo. at 6%.
10 Find the interest on $435.12 for 10 mo. at 6%.

Int. on $1.00 for 20 mo. at 6% = $0.10.
Int. on $500.00 for 20 mo. at 6% = $50.00.
Int. on $112.00 for 20 mo. at 6% = $11.20.
Int. on $1.00 for 2 mo. at 6% = $0.01.
Int. on $500.00 for 2 mo. at 6% = $5.00.
Int. on $112.00 for 2 mo. at 6% = $1.12.

Observe that in each case the interest for 2 mo. at 6% is $\frac{1}{100}$ of the principal. The interest on any principal for 2 mo. at 6% is $\frac{1}{100}$ of it. $\frac{1}{100}$ may be most easily found by moving the decimal point two places toward the left.

Written Exercises

1 Find the interest on $600.00 for 2 mo. at 6%.
2 Find the interest on $435.00 for 2 mo. at 6%.
3 Find the interest on $897.00 for 2 mo. at 6%.
4 Find the interest on $14.00 for 2 mo. at 6%.
5 Find the interest on $27.80 for 4 mo. at 6%.
6 Find the interest on $87.45 for 6 mo. at 6%.
7 Find the interest on $85.42 for 8 mo. at 6%.
8 Find the interest on $43.45 for 9 mo. at 6%.
9 Find the interest on $500.00 for 14 mo. at 6%.
10 Find the interest on $384.50 for 17 mo. at 6%.

Int. on $1.00 for 2 mo. or 60 da. at 6% = $0.01.
Int. on $500.00 for 2 mo. or 60 da. at 6% = $5.00.
Int. on $112.00 for 2 mo. or 60 da. at 6% = $1.12.
Int. on $1.00 for 6 da. at 6% = $0.001.
Int. on $500.00 for 6 da. at 6% = $0.50.
Int. on $112.00 for 6 da. at 6% = $0.112.

Observe that in each case the interest for 6 days at 6% is $\frac{1}{1000}$ of the principal. The interest on any principal for 6 days at 6% is $\frac{1}{1000}$ of it. $\frac{1}{1000}$ may be most easily found by moving the decimal point three places toward the left.

Written Exercises

1 Find the interest on $630.00 for 6 da. at 6%.
2 Find the interest on $434.00 for 6 da. at 6%.
3 Find the interest on $297.00 for 6 da. at 6%.
4 Find the interest on $348.00 for 12 da. at 6%.
5 Find the interest on $276.00 for 18 da. at 6%.
6 Find the interest on $425.00 for 24 da. at 6%.
7 Find the interest on $216.00 for 9 da. at 6%.
8 Find the interest on $45.00 for 8 da. at 6%.
9 Find the interest on $300.00 for 7 da. at 6%.
10 Find the interest on $36.00 for 11 da. at 6%.

II. Find the interest on $548.00 for 1 yr. 8 mo. 6 da. at 6%.
1 yr. 8 mo. = 20 mo.
Int. on $548.00 for 20 mo. at 6% = $54.80
Int. on $548.00 for 6 da. at 6% = .548
$55.348 = $55.35, Ans

III. Find the interest on $314.50 for 2 yr. 2 mo. 2 da. at 6%.
2 yr. 2 mo. = 26 mo.
Int. on $314.50 for 20 mo. at 6% = $31.45
(Int. on $314.50 for 2 mo. at 6%) = $3.145.
Int. on $314.50 for 6 mo. at 6% = 9.435
(Int. on $314.50 for 6 da. at 6%) = $0.3145.
Int. on $314.50 for 2 da. at 6% = .1048
$40.9898 = $40.99, Ans.

When interest at a rate other than 6% is to be found, first find it at 6% and then from that result compute the interest at the required rate.

Illustrations:

I. Find the interest on $500.00 for 2 yr. 6 mo. at 3%.
Int. on $500.00 for 2 yr. 6 mo. at 6% = $75.00.
Int. on $500.00 for 2 yr. 6 mo. at 3% = ½ of $75.00 = $37.50, Ans.

II. Find the interest on $300.00 for 1 yr. 8 mo. at 9%.

Int. on $300.00 for 1 yr. 8 mo. at 6% = $30.00
Int. on $300.00 for 1 yr. 8 mo. at 3% = $15.00
(6% + 3% = 9%) $45.00, Ans.

Suggestions:

$1\% = \frac{1}{6}$ of 6%
$1\frac{1}{5}\% = \frac{1}{5}$ of 6%
$1\frac{1}{2}\% = \frac{1}{4}$ of 6%
$2\% = \frac{1}{3}$ of 6%
$3\% = \frac{1}{2}$ of 6%
$4\% = \frac{2}{3}$ of 6%
$4\frac{1}{2}\% = \frac{3}{4}$ of 6%
$5\% = \frac{5}{6}$ of 6%
$7\% = \frac{7}{6}$ of 6%
$7\frac{1}{2}\% = \frac{5}{4}$ of 6%
$8\% = \frac{4}{3}$ of 6%
$9\% = \frac{3}{2}$ of 6%

The **amount** equals the sum of the principal and the interest

Illustration:

I. Find the amount of $560.00 on interest at 4½% from Feb 8, 1906 to Oct. 12, 1906.

Time from Feb. 8, 1906 to Oct. 12, 1906 = 8 mo. 4 da.
Int. on $560.00 for 8 mo. 4 da. at 4½% = $17.08.
$560.00 + $17.08 = $577.08, Ans.

Written Exercises

1 Find the interest on $320.00 for 1 yr. 8 mo. at 6%.
2 Find the interest on $638.00 for 2 yr. 4 mo. at 6%.
3 Find the interest on $1273.00 for 3 yr. 2 mo. 12 da. at 6%.
4 Find the interest on $176.00 for 2 yr. 1 mo. 18 da. at 5%.
5 Find the interest on $2,816.00 for 6 yr. 3 mo. 24 da. at 4%
6 Find the interest on $372.00 for 5 yr. 2 mo. 6 da. at 7%.
7 Find the interest on $138.40 for 4 yr. 5 mo. 15 da. at 8%.
8 Find the interest on $936.20 for 3 yr. 9 mo. 21 da. at 4%.
9 Find the interest on $1,004.00 for 4 yr. 3 mo. 10 da. at 6%
10 Find the interest on $3,816.00 for 8 yr. 6 mo. 20 da. at 5%
11 Find the interest on $982.24 for 1 yr. 3 mo. 25 da. at 3%.
12 Find the interest on $1,764.15 for 4 mo. 8 da. at 4½%.
13 Find the interest on $246.00 for 9 mo. 3 da. at 8%.
14 Find the interest on $12,450.00 for 1 yr. 2 mo. 7 da. at 7%.
15 Find the interest on $376.43 for 4 yr. 6 mo. 15 da. at 6%.
16 *Find the* interest on $125.00 for 3 yr. 5 mo. 17 da. at 4%.
17 *Find the interest* on $2,750.00 for 5 yr. 1 mo. 14 da. at 4½%.

18 Find the interest on $138.00 for 12 yr. 6 mo. 12 da. at 3½%.

19 Find the interest on $563.25 for 16 yr. 8 mo. at 7%.

20 Find the interest on $143.17 for 9 yr. 7 mo. 10 da. at 6%.

21 Find the amount of $425.00 for 8 yr. 4 mo. at 5%.

22 Find the amount of $1,076.50 for 2 yr. 3 mo. 16 da. at 5½%.

23 Find the amount of $416.94 for 5 yr. 1 mo. 15 da. at 6%.

24 Find the amount of $1,200.00 for 2 yr. 6 mo. 18 da. at 4%.

25 Find the amount of $9,863.12 for 4 yr. 7 mo. 6 da. at 2%.

26 Find the interest of $864.30 from Jan. 10, 1906 to May 16, 1908 at 6%.

27 Find the interest of $1,764.00 from Feb. 14, 1906 to July 17, 1907 at 7%.

28 Find the interest of $398.25 from July 10, 1902 to Jan. 1 1906 at 4%.

29 Find the interest of $416.38 from May 19, 1904 to Mar. 1, 1906 at 4½%.

30 Find the interest of $1,923.00 from Aug. 15, 1905 to Mar. 9, 1907 at 5%.

To find the rate

Illustration:

I. At what rate will $536.00 gain $40.736 in 2 yr. 6 mo. 12 da.?

(Find the interest at 1%.)

Int. on $536.00 for 2 yr. 6 mo. 12 da. at 1% = $13.578⅔.

$40.736 ÷ 13.578⅔ = 3 times.

Therefore 3%, Ans.

To find the time

Illustration:

I. In what time will $455.00 gain $45.955 at 6%

(Find the interest for 1 yr.)

Interest on $455.00 for 1 yr. at 6% = $27.30.

$45.955 ÷ $27.30 = 1$\frac{3731}{5460}$ times, therefore 1$\frac{3731}{5460}$ yr

$\frac{3731}{5460}$ of 12 mo. = 8$\frac{91}{455}$ mo.

$\frac{91}{455}$ of 30 da. = 6 da.

1 yr. 8 mo. 6 da., Ans.

To find the principal

Illustration:

I. How many dollars on interest at 4½% will gain $26.25 in 1 yr. 2 mo.?

(Find the interest on $1.00.)
Int. on $1.00 for 1 yr. 2 mo. at 4½% = $0.0525.
$26.25 ÷ $0.0525 = 500 times.
Therefore $500.00, Ans.

Illustration

I. How many dollars on interest at 7½% will amount to $458.15 in 6 mo. 18 da.

(Find the amount of $1.00.)
Amt. of $1.00 for 6 mo. 18 da. at 7½% = $1.04125.
$458.15 ÷ $1.04125 = 440 times.
Therefore $440.00, Ans.

Written Exercises

1 At what rate will $1,600.00 gain $12.00 in 1 mo. 15 da.?

2 At what rate will $1,200.00 gain $164.40 in 2 yr. 3 mo 12 da.?

3 At what rate will $660.00 gain $52.47 in 1 yr. 9 mo. 6 da.?

4 At what rate will $1.860.00 amount to $2,146.44 in 2 yr 6 mo. 24 da.?

5 At what rate will $425.00 amount to $463.25 in 1 yr. 9 mo. 18 da.?

6 In what time will $480.00 gain $79.20 at 6%?
7 In what time will $1,360.00 gain $142.80 at 5%?
8 In what time will $1,260.00 gain $81.90 at 5%?
9 In what time will $330.00 amount to $358.38 at 4%?
10 In what time will $1,500.00 amount to $1,581.00 at 4½%?
11 What principal at 4% will gain $5.875 in 2 yr. 4 mo. 6 da.?
12 *What principal* at 6% will gain $54.81 in 5 yr. 27 da.?
13 *What principal* at 5% will gain $299.70 in 1 yr. 4 mo. 6 da.?

14 What principal at 5% will gain $265.30 in 8 mo. 12 da.?

15 What principal at 3% will gain $275.48 in 7 mo. 3 da.?

16 What principal at 6% will amount to $594.81 in 1 yr. 8 mo. 9 da.?

17 What principal at 5% will amount to $551.00 in 3 yr. 2 mo. 12 da.?

18 What principal at 4½% will amount to $535.05 in 4 yr. 2 mo. 12 da.?

19 What principal at 7% will amount to $876.60 in 4 yr. 5 mo. 6 da.?

20 What principal at 3% will amount to $1,234.87 in 1 yr. 6 mo. 18 da.?

PERCENTAGE—ACCURATE INTEREST

In figuring accurate interest the number of **entire years,** and the **exact number of days** must be used.

(The interest need not be first found at 6%.)

Illustrations:

I. Find the accurate interest on $200.00 for 61 da. at 4%

61 da. $= \frac{61}{365}$ yr.
Int. on $200.00 for 1 yr. at 4% = $8.00.
Int. on $200.00 for $\frac{61}{365}$ yr. at 4% = $\frac{61}{365}$ of $8.00 =
$1.34, Ans

II Find the accurate interest on $300.00 from Mar. 6, 1905 to July 5, 1906 at 5%.

Time from Mar. 6, 1905 to Mar. 6, 1906 = 1 yr.
Mar. 6, 1906 to July 5, 1906 =
Remaining number of days in Mar. 25
Apr. 30
May 31
June 30
July 5
121 days.

Int. on **$1.00** for 1 yr. at 5% = **$0.05**.
Int. on **$300.00** for 1 yr. at 5% = **$15.00**.
121 days = $\frac{121}{365}$ yr.
Int. on **$300.00** for $\frac{121}{365}$ yr. at 5% = $\frac{121}{365}$ of **$15.00** = **$4.97**.
$15.00 + **$4.97** = **$19.97**, Ans.

Written Exercises

1 Find the accurate interest on $836.00 for 3 mo. 15 da. at 6%.

2 Find the accurate interest on $12.64 for 9 da. at 8%.

3 Find the accurate interest on $138.90 for 1 yr. 2 mo. 10 da. at 5%.

4 Find the accurate interest on $415.00 for 4 mo. 20 da. at 4½%.

5 Find the accurate interest on $1,724.60 for 1 yr. 3 mo. 18 da. at 3%.

6 Find the accurate interest on $318.00 from Jan. 14, 1902 to July 16, 1902 at 6%.

7 Find the accurate interest on $92.00 from Feb. 13, 1905 to Oct. 6, 1905 at 4%.

8 Find the accurate interest on $1,324.00 from May 18, 1904 to Sept. 6, 1905 at 5%.

9 Find the accurate interest on $268.75 from July 26, 1906 to Mar. 10, 1907 at 4%.

10 Find the accurate interest on $1,390.00 from Apr. 16, 1904 to Mar. 1, 1906 at 3%.

PERCENTAGE—COMPOUND INTEREST

Compound Interest is interest computed upon the principal and unpaid interest at stated intervals.

Whenever interest is compounded, the amount due at that time is the principal upon which the interest for the succeeding *period of time* is figured.

Interest is compounded annually unless otherwise stated.

Illustrations:

I. Find the compound interest on $500.00 for 2 yr. 6 mo. 15 da at 4%.

Int. on $500.00 for 1 yr. at 4% = $20.00.
Amount due at end of first year, $520.00.
Int. on $520.00 for 1 yr. at 4% = $20.80.
Amount due at end of second yr., $540.80.
Int. on $540.80 for 6 mo. 15 da. at 4% = $11.72.
Amount due at the end of 2 yr. 6 mo. 15 da. = $552.52.
$552.52 − $500.00 = $52.52, Ans.

II. Find the compound interest on $350.00 for 1 yr. 9 mo at 6% compounded semi-annually.

Int. on $350.00 for 6 mo. at 6% = $10.50.
Amount due at end of first half year, $360.50.
Int. on $360.50 for 6 mo. at 6% = $10.82.
Amount due at end of second half year, $371.32.
Int. on $371.32 for 6 mo. at 6% = $11.14.
Amount due at end of third half year, $382.46.
Int. on $382.46 for 3 mo. at 6% = $5.74.
Amount due at end of 1 yr. 9 mo., $388.20.
$388.20 − $350.00 = $38.20, Ans.

Written Exercises

1 Find the compound interest on $1,200.00 at 6% for 1 yr. 8 mo. 12 da.

2 Find the compound interest on $436.00 at 4% for 2 yr. 4 mo. 18 da.

3 Find the compound interest on $815.00 at 5% for 3 yr. 9 mo. 6 da.

4 Find the compound interest on $126.00 at 7% for 4 yr. 1 mo. 15 da.

5 Find the compound interest on $539.00 at 3% for 5 yr. 3 mo.

6 Find the compound interest on $128.50 at 6% for 8 yr. 10 mo. 20 da.

7 Find the compound interest on $1,876.00 at 8% for 4 yr. 2 mo. 1 da.

8 Find the compound interest on $1,000.00 at 5% for 1 yr. 7 mo. (semi-annually).

9 Find the compound interest on $1,600.00 at 4% for 2 yr. 2 mo. 6 da. (semi-annually).

10 Find the compound interest on $486.00 at 4½% for 2 yr. 8 mo. 21 da. (semi-annually).

11 Find the compound interest on $916.00 at 3½% for 1 yr. 9 mo. 16 da. (semi-annually).

12 Find the compound interest on $1,125.00 at 4% for 9 mo 15 da. (quarterly).

13 Find the compound interest on $2,000.00 at 7% for 11 mo 4 da. (quarterly).

14 Find the compound interest on $3,600.00 at 5% for 1 yr. 4 mo. 18 da. (quarterly).

15 Find the compound interest on $1.423.00 at 6% for 1 yr. 7 mo. 4 da. (quarterly).

COMMERCIAL PAPER—BILLS

Illustrations:

I. On Jan. 8, 1906, J. A. Small & Co., wholesale lumber dealers of Kansas City, Mo., sold to H. O. Whitner, a contractor, the following amount of lumber: 3000 ft. hard pine board sat $22.00; 5½ thousand shingles at $4.00; 300 ft. of oak at $48.00. On Feb. 12, 1906, Whitner sent Small & Co. his check for $100.00. On April 14, 1906, Whitner bought of Small & Co., 14,000 ft. hemlock boards at $17.00. Make out a statement of the account as taken from the books of J. A. Small & Co., on May 1, 1906, and receipt it.

Kansas City, Mo., May 1, 1906.

H. O. Whitner,
To J. A. Small & Co., Dr.,

1906 Jan.	8	3,000 ft. hard pine boards	$22.00	$66 00	
		5½ M shingles	4.00	22 00	
		300 ft. oak	48.00	14 40	
Apr.	14	14,000 ft. hemlock boards	17.00	238 00	340 40
		Credit			
Feb.	12	By check			100 00
					$240 40

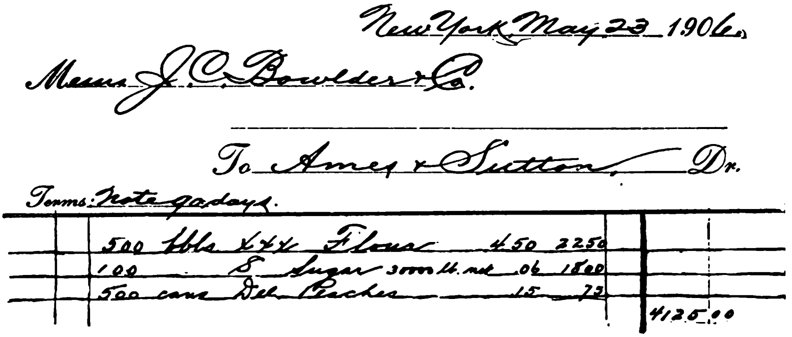
Received payment,
May 1, 1906.
J. A. Small & Co.

II. On May 1, 1901, Fred Albers, a commission merchant, owed Samuel Jones on account $249.16. May 3, Jones sent Albers 6,800 pounds of beef, which he sold at 9¢ per pound, charging ½% commission. May 8, Albers sold Jones 75 head of cattle weighing 95,840 pounds at $5.30 per 100 pounds. May 16, Albers sold for Jones 2,000 bushels of corn at 60¢ per bushel, charging 1% commission and $50.00 storage. May 24, Jones bought of Albers 12,500 feet of lumber at $14.00 per thousand. May 28, Albers received from Jones a note for $800.00. May 31, Jones paid a draft drawn on him by Albers for $500.00. Make an itemized statement of the above account as it should appear taken from the books of Jones; *make a proper heading, close the account and bring down the balance due June 1, 1901.*

Fred Albers IN ACCOUNT WITH Samuel Jones

Dr. Cr.

1901					1901				
May	1	To balance on acct.	$ 249	16	May	3	By Com. on beef	$ 3	06
May	3	To 6800 lb. beef @ $0.09	612	00	May	8	By 75 head cattle, 95,840 lb. @ $5.30 per hundred	5,079	52
May	16	To 2,000 bu. corn @ $0.60	1,200	00	May	16	By Com. on corn	12	00
May	28	To note	600	00	May	16	By Storage	50	00
May	31	To draft	500	00	May	24	By 12,800 ft. lumber @ $14.00	179	20
June	1	To balance	2,162	62					
			$5,323	78				$5,323	78
					June	1	By balance	$2,162	62



New York, May 23 1906.

Messrs. J. C. Bowlder & Co.

To Ames & Sutton, Dr.

Terms: Note 90 days.

500 bbls XXX Flour 4.50 2250		
100 " S Sugar 30000 lb. net .06 1800		
500 cans Del. Peaches .15 75		
		4125.00

Written Exercises

1 On May 1, 1906, Henry M. Smith bought of J. C. Hill & Co., 5 lb. lard at 12⅗¢; 1 lb. crackers, 13¢; 1 box soap, $7.25; 1 lb. fig bars, 10¢; May 5, 2 lb. salt fish at 14¢; 2 cans salmon at 16¢; 1 jar cream, 15¢; May 10, 2 lb. crackers at 10¢; 1 doz. eggs at 27¢; 2 qt. beans at 12¢; May 12, 2 lb. coffee at 30¢; 2 yeast cakes at 2¢.; 1 bottle olives, 25¢. Make out and receipt the bill.

2 James G. Harris bought of Thomas Higgins: May 10, 1906, 1 floor polishing brush, $2.50; 1 lb. floor wax, 50¢; 30 ft. ⅞" rope, (9 lb.) at 16¢ a lb.; 45 ft. wire screening at 2½¢ a ft.; pkg. tacks, 5¢; ½ lb. brads, 8¢. Make out and receipt the bill.

3 *Thomas G. West*, to Eldridge & Sons, Dr. June 1, 1902, *1 bedstead, $14.25;* 1 bureau, $22.75; 1 stove, $19.76; 1 table, *$23.25; ½ doz. chairs*, $15.00; 1 desk, $31.50; 1 bookcase, $43.80

1 table, $30.20. July 1, cash on account, $50.00. Aug. 1 the bill was paid in full. Find the amount of the bill. Make out and receipt the bill.

4 Charles S. Downey bought of S. S. Pierce Co., May 1, 1906, 3 lb. box fish, 48¢; 1 lb. walnuts, 18¢; ¼ lb. tea, 13¢; 1 yeast cake, 2¢; May 5, 1 pkg. Force, 15¢; ½ lb. salted nuts, 35¢; May 9, 1 lb. chocolates, 70¢; May 10, 1 bottle olives, 11¢; 1 pkg. dried beef, 15¢; 1 lb. crackers, 10¢; 2 pkgs. gelatine, 25¢; 10 lb. sugar, 50¢; On May 12 he returned 6 bottles for which he was credited 2¢ each. Make out and receipt the bill.

5 On Mar. 24, Geo. E. Raymond bought of the Schœnhof Book Co. 35 copies of Hill's French Dictionary at 25¢ each. On April 7, he bought 35 more copies of the same book. On May 11 he returned 14 copies. Make out and receipt the bill.

Due Bill

$600.00. New Orleans, La., June 16, 190

Due James F. Holmes six hundred dollars in cash or in goods at our stores.

Adams & Ames

Order

I. Savannah, Ga., April 11, 1906.

Please deliver to J. O. Hamlins or order,
1 hhd. molasses,
500 lb. sugar,
and charge the same to our account.

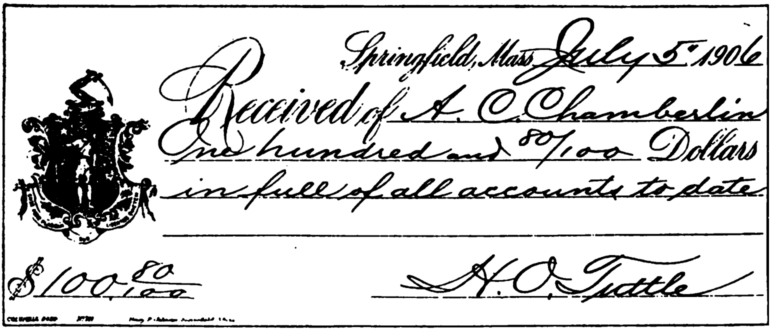
A. B. Chadwicks & Co.

II. Cleveland, Ohio, June 8, 1906.

Please pay J. O. Hamlins sixty dollars and charge the same to our account.

A. B. Chadwicks & Co

Receipts



Springfield, Mass. July 5th 1906

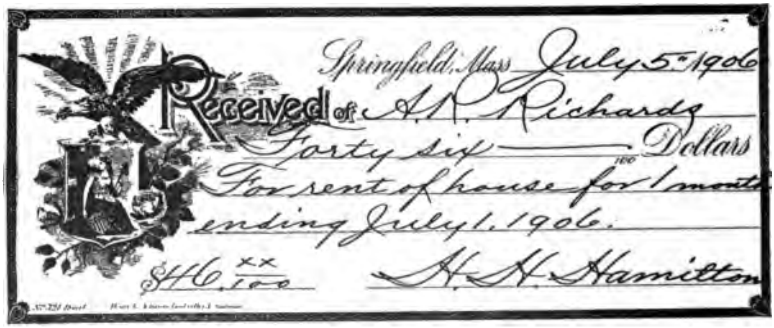
Received of A. C. Chamberlin

One hundred and 80/100 Dollars

in full of all accounts to date

$100 80/100

H. O. Tuttle



Springfield, Mass. July 5th 1906

Received of A. R. Richards

Forty six —— 100 Dollars

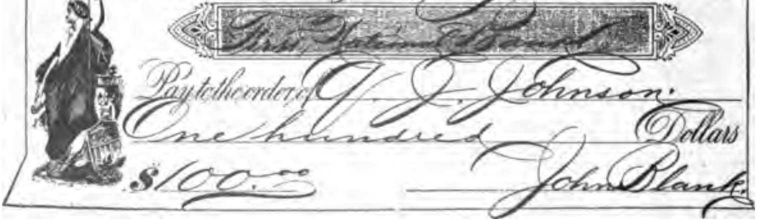
For rent of house for 1 month

ending July 1, 1906.

$46 xx/100

H. H. Hamilton

Bank Check



No. 110. Bangor Me. July 15th 1905.

First National Bank

Pay to the order of G. J. Johnson.

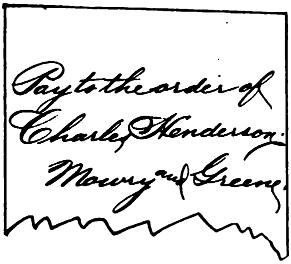
One hundred Dollars

$100.00

John Blank.

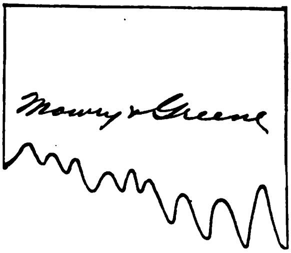
Indorsement of Bank Check

Indorsement in Full.



Pay to the order of
Charles Henderson.
Mowry and Greene.

Indorsement in Blank.

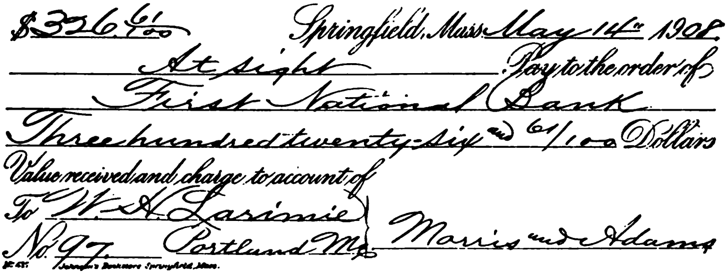


Mowry & Greene

Note: The indorsement should be written on the back side of the left hand end.

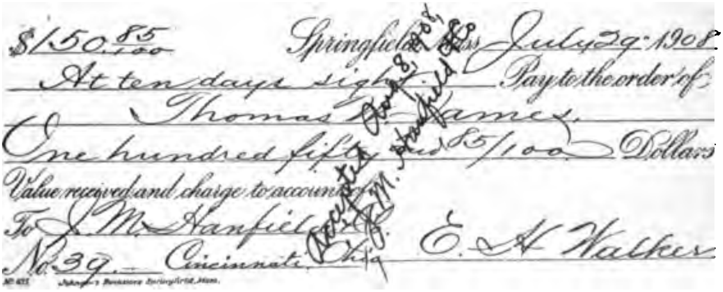
DRAFTS

Sight Draft



$326 61/100 Springfield, Mass. May 14th 1908.
At sight Pay to the order of
First National Bank
Three hundred twenty-six and 61/100 Dollars
Value received and charge to account of
To W. H. Larimie
No. 97. Portland, Me. Morris and Adams
Johnson's Bookstore Springfield, Mass.

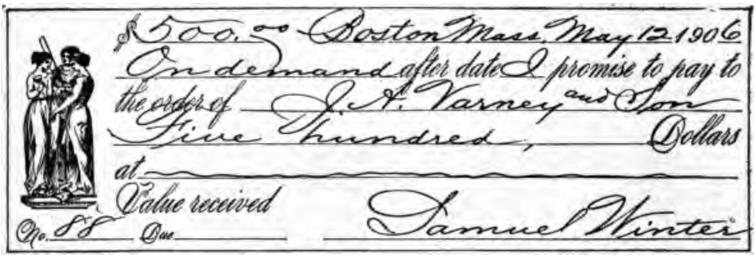
Time Draft



$150 85/100 Springfield, Mass. July 29, 1908.
At ten days sight Pay to the order of
Thomas T. James.
One hundred fifty and 85/100 Dollars
Value received and charge to account of
To J. M. Hanfield & Co.
No. 39. Cincinnati, Ohio E. H. Walker
Accepted Aug. 8, 1908.
J. M. Hanfield & Co.
Johnson's Bookstore Springfield, Mass.

Note: Observe that the above draft has been presented to J. M. Hanfield & Co. for their acceptance.

NOTES



$500.00 Boston Mass. May 12 1906

On demand after date I promise to pay to the order of J. A. Varney and Son

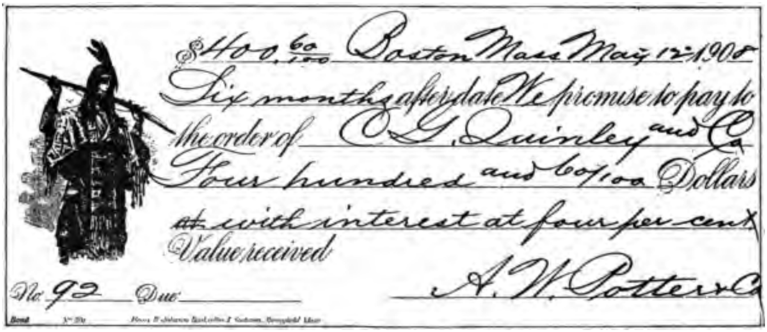
Five hundred Dollars

at

Value received

No. 88 Due

Samuel Winter



$400.60/100 Boston Mass May 12 1906

Six months after date We promise to pay to the order of C. G. Quinley and Co

Four hundred and 60/100 Dollars

~~at~~ with interest at four per cent

Value received

No. 92 Due

A. W. Potter & Co

3 Promissory, Time, Non-Negotiable, Interest-Bearing.

$\$100\frac{xx}{100}$ Austin, Tex., May 12, 1906.

One year from date, for value received, I promise to pay S. W White one hundred dollars with interest at six per cent.

W. H. Holmers.

4 Promissory, Time, Negotiable, Non-Interest-Bearing, Witnessed.

$\$246\frac{81}{100}$ Seattle, Wash., May 12, 1906.

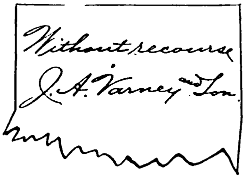
Sixty days after date, for value received, we jointly and severally promise to pay to the order of T. H. Jameson two hundred forty-six and $\frac{81}{100}$ dollars.

H. W. Brown,
J. A. Armes,

Witness, C. G. Bisbern.

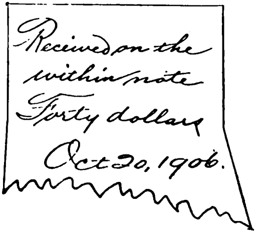
Indorsement of Notes

Indorsement without Recourse.



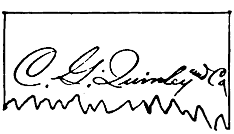
Without recourse
J. A. Varney and Son.

Indorsement of Payment.



Received on the
within note
Forty dollars
Oct 20, 1906.

Indorsement in Blank.



C. G. Quinley and Co

PERCENTAGE—BANK DISCOUNT

The holder of a negotiable note may sell the same before it becomes due. This is usually done at banks, where a certain amount is deducted from the amount due at the maturity of the note. The amount deducted is the simple interest on **the amount due at maturity** for the time the bank is to hold the note, at the rate agreed upon when the note is sold, and this is called the **bank discount.**

The "Term of Discount" is the time that the note is to be held by the purchaser. It is the time from the day of discount to the day of maturity. In finding the term of discount, count exact days, not months and days.

Bank Discount is simple interest computed upon the amount due at maturity for the term of discount at the rate agreed upon.

The **Proceeds** is the amount received for the note when it is sold, or the value of the note at maturity less the discount.

Illustrations:

I. T. H. Jameson discounts his note (see page 154, note number 4), on June 12 at 4%.

Find the bank discount and the proceeds.
The day of maturity is July 11.
Time from June 12 to July 11 = 29 da.
Int. on $246.81 for 29 da. at 4% = $0.80, bank discount Ans
$246.81 − $0.80 = $246.01, Proceeds, Ans.

II. C. G. Quinley & Co. discount their note, (see page 154, note number 2), at the Merchants' National Bank, on July 14, at 6%. Find the bank discount and the proceeds.

Int. on $400.60 for 6 mo. at 4% = $8.01.
Amt. due at maturity, $408.61.
Time from July 14 to day of maturity (Nov. 12) = 121 da. = 4 mo. 1 da.
Int. on $408.61 for 4 mo. 1 da. at 6% = $8.24, bank dis.
$408.61 − $8.24 = $400.37, Proceeds, Ans.

Written Exercises

Find the Bank Discount and Proceeds:

	Face	Date	Time	Day of Discount	Rate of Discount
1	$300.00	Jan. 16, 1904	6 mo.	May 1	6%
2	$450.00	Apr. 21, 1902	5 mo.	June 14	7%
3	$176.00	July 14, 1905	1 yr.	Dec. 7	6%
4	$380.00	May 1, 1906	4 mo.	May 19	5%
5	$124.50	June 18, 1906	5 mo.	Aug. 5	5½%
6	$45.00	Nov. 17, 1905	3 mo.	Nov. 23	5%
7	$960.00	Apr. 14, 1901	4 mo.	Apr. 14	4½%
8	$1,876.00	Aug. 18, 1903	4 mo.	Oct. 11	6%
9	$426.00	Dec. 13, 1904	90 da.	Dec. 26	8%
10	$1,740.00	Oct. 10, 1905	60 da.	Oct. 10	7%

	Face	Rate of Interest	Date	Time	Date of Discount	Rate
11	$197.00	6%	July 1, 1905	6 mo.	Sept. 15	7%
12	$418.00	5%	Feb. 16, 1906	4 mo.	Apr. 10	6%
13	$365.00	7%	Sept. 21, 1905	3 mo.	Oct. 28	6%
14	$1,000.00	5%	Aug. 13, 1906	4 mo.	Aug. 18	5½%
15	$840.00	6%	Nov. 10, 1906	6 mo.	Mar. 22	7%

PARTIAL PAYMENTS

Persons owing notes often wish to pay a part of the amount owed before it is due, that the principal upon which they are paying interest may be reduced.

When these part payments are made, they are indorsed on the back of the note. When the note is settled, the amount of the indorsement is subtracted from the amount due (including interest) at the time of indorsement.

Some notes are so worded that part payments become due at stated intervals.

Illustration:

I. Mr. Holmer's note on page 154 was indorsed as follows: July 12, 1906, $20.00; Jan. 5, 1907, $50.00. How much was due *May 12, 1907?*

Time from date of note to July 12, 1906 = 2 mo.

Int. on face of note $100.00 for 2 mo. at given rate, (6%) = $1.00.

Amt. due July 12, 1906 = $100.00 + $1.00 = $101.00
Payment 20.00
Amt. due after payment $81.00

Time from July 12, 1906 to Jan. 5, 1907 = 5 mo. 24 da.

Int. on $81.00 for 5 mo. 24 da. at 6% = $2.35.

Amt. due Jan. 5, 1907 = $81.00 + $2.35 = $83.35
Payment 50.00
Amt. due after payment $33.35

Time from Jan. 5, 1907 to May 12, 1907 = 4 mo. 7 da.

Int. on $33.35 for 4 mo. 7 da. at 6% = $0.71.

Amt. due May 12, 1907 = $33.35 + $0.71 = $34.06 Ans

Written Exercises

1 Jan. 10, 1900, A borrowed $500.00 of B, agreeing to pay interest at the rate of 6%. Nov. 13, 1906 he paid $300; Jan. 1, 1907, he paid $100.00. Find the amount due Jan. 1, 1908.

2 May 31, 1898, Mr. Batchelder borrowed $1,200.00 of Mr Allen, promising to pay 5% interest. Jan. 18, 1899, he paid $800.00. July 31, 1900, he paid $400.00. Find the amount unpaid and due July 1, 1902.

3 On Feb. 15, 1899, Mr. Randall bought of Mr. Littlefield on credit a bill of goods amounting to $720.00, agreeing to pay interest at 4%. On Jan. 1, 1900, he paid $325.00 and on April 20, 1901 he paid $375.00. Find the amount due Jan. 1, 1902.

4 Borrowed $960.00 Feb. 13, 1903. Paid $100.00 Oct. 2, 1903; $200.00, July 1, 1904. Find the amount still unpaid Jan. 1, 1905. Interest at 5½%.

5 Sept. 18, 1905, a man bought a horse for $322.00, paying $150.00 cash, and giving a note for the balance, with interest at 7%. Paid $50.00, Jan. 28, 1906, and the balance Mar. 14, 1907. Find the *amount paid* on the last date.

CONVERSION OF CURRENCY

Country	Monetary Unit		Value
Argentina	Peso		$0.965
Austria-Hungary	Crown		.203
Belgium	Franc		.193
Bolivia	Boliviano		.393
Brazil	Milreis		.546
British Honduras	Dollar		1.000
Central American States—			.465
Costa Rica	Colon		
Guatemala	Peso		.393
Honduras			
Nicaragua			
Salvador			
Chile	Peso		.365
Chinese Empire	Tael	Amoy	.644
		Canton	.642
		Chefoo	.616
		Chin Kiang	.629
		Fuchau	.595
		Haikwan (customs)	.655
		Hankow	.602
		Nankin	.637
		Niuchwang	.604
		Ningpo	.619
		Peking	.628
		Shanghai	.588
		Swatow	.595
		Takau	.648
		Tientsin	.624
	Dollar	Hongkong	.423
		British	.423
		Mexican	.427
Colombia	Dollar		1.000
Denmark	Crown		.268
Ecuador	Sucre		.487
Egypt	Pound (100 piastres)		4.943
Finland	Mark		.193
France	Franc		.193
German Empire	Mark		.238
Great Britain	Pound sterling		4.866½
Greece	Drachma		.193
Haiti	Gourde		.965
India	Pound sterling		4.866½
Italy	Lira		.193
Japan	Yen		.498
Liberia	Dollar		1.000
Mexico	Peso		.498
Netherlands	Florin		.402
Newfoundland	Dollar		1.014
Norway	Crown		.268

Panama	Balboa	1.000
Persia	Kran	.072
Peru	Libra	4.866½
Philippine Islands	Peso	.50
Portugal	Milreis	$1.080
Russia	Ruble	.515
Spain	Peseta	.193
Sweden	Crown	.268
Switzerland	Franc	.193
Turkey	Piastre	.044
Uruguay	Peso	1.034
Venezuela	Bolivar	.193

Note: The coins of silver standard countries are valued according to their contents of pure silver.

The value of foreign currency changes from time to time. This is shown in tables prepared by the Director of the Mint and published by the government at regular intervals.

It is not necessary to memorize the values of these units.

In problems involving the conversion of currency, the value of the foreign monetary unit will probably be given. In solving the following problems refer to the preceding table:

Illustrations:

I. Find the value of 487 liras in U. S. currency.

1 lira = $0.193.

487 liras = 487 times $0.193 = $93.99, Ans.

II. Finish making out the following bill and find the equivalent amount in U. S. currency. "1/6" means 1 s. 6 d. 1 £ = 20 s. 1 s. = 12d.

London, England, May 23, 1907

Messrs. James & Holmes,
To Wright & Cockburn, Dr.,

		£	s.	d.	£	s.	d.
450 yd. linen	1/6						
200 yd. woolen cloth	3/6						
150 yd. woolen cloth	5/8						

London, England, May 23, 1907

Messrs. James & Holmes,
To Wright & Cockburn, Dr.,

		£	s.	d.	£	s.	d.
450 yd. linen	1/6	33	15				
200 yd. woolen cloth	3/6	35					
150 yd. woolen cloth	5/8	42	10		111	5	

450 times 1. s. 6 d. = 450 s. 2,700 d.
2,700 d. = 225 s. (2,700 ÷ 12).
450 s. + 225 s. = 675 s.
675 s. = 33 £, 15 s.
200 times 3 s. 6 d. = 600 s. 1,200 d.
600 s. 1,200 d. = 35 £.
150 times 5 s. 8 d. = 750 s. 1,200 d.
750 s. 1,200 d. = 42 £. 10 s.
111£. 5 s. = 111¼ £.
111¼ times $4.8665 = $541.40, Ans.

III. Change $41.54 to Danish crowns.
$41.54 ÷ $0.268 = 155 times, therefore 155 crowns, Ans.

Written Exercises

1

Paris, France, May 23, 1906

Gendrot, Gagné & Co.,

Sold to Whittier, Jones & Co.,

Marks & Numbers	Descriptions	Price	Amount		Consular Corrections
	856 yd. organdie	$2.45	$2,097	20	
	314 yd. madras	1.75	549	50	
			$2646	70	

NOTE: In this invoice the amount is to be expressed in the currency of France

2

Cadiz, Spain, May 28, 1906

Cerrarot & Weyler,

Sold to James F. Connor & Sons,

Marks & Numbers	Descriptions	Price	Amount		Consular Corrections
	1,563 cases olives (bottled)	$12.50	$19,537	50	

NOTE: In this invoice the amount is to be expressed in the currency of Spain

3 London, England, May 29, 1906.

Coleman, Cameron & Co., Ltd.,
Sold to Asher, Holmes & Co.,

Marks & Numbers	Description	Price	Amount			Consular Corrections
No. 628	1,400 yd. woolen cloth	4/6	315			
No. 814	214½ yd. woolen cloth	6/4	67	18	6	
			382	18	6	

Note: In this invoice the amount is in pounds, shillings, and pence. Change it to U. S. currency.

4 Berlin, Germany, May 21, 1906.

Schmidt, Diess & Co.,
Sold to Graham, Moore & Co.,

Marks & Numbers	Description	Price	Amount		Consular Corrections
AA141	2 gross pen knives	$70.00	$ 140	00	
C24	25 doz. razors	48.50	1,212	50	
			$1,352	50	

Note: In this invoice the amount is to be expressed in marks and pfennigs.

FOREIGN CURRENCY

English

12 pence = 1 shilling. 20 shillings = 1 pound = $4.8665

French

100 centimes = 1 franc = $0.193

German

100 pfennige = 1 mark = $0.238

Italian

100 centimes = 1 lira (plural lire) = $0.193

Spanish

100 centimes = 1 peseta = $0.193

SQUARE ROOT

The square of a number is the product obtained by multiplying that number by itself. Thus 16 is the square of 4.

The square root of a number is that number which, multiplied by itself will produce the number. Thus 7 is the square root of 49

The method of finding the square root of any number is given below.

Starting from the decimal point, divide the number into periods or groups of two figures each. (The period to the left may contain only one figure, thus 1′53′76.)

For the first figure of the answer take the largest number whose square is not greater than the first period (on the left).

Square this figure, place the square under the first period subtract, and bring down the next period, forming a "new dividend."

To the left, and on the same line with this "new dividend," place a number equal to twice the part of the answer already found. This is called a "trial divisor."

Square Root

```
    1′53′76(1
    1
 2)  53
```

To obtain the next figure of the answer, divide the new dividend dropping the last figure, by this trial divisor. Place this figure to the right in the answer **and in the trial divisor** Thus,

```
    1′53′76.(12
    1
22)  53
```

Multiply the trial divisor by the last figure of the answer, place the result under the new dividend, subtract and bring down the next period, as before.

```
    1′53′76.(12
    1
22)  53
     44
     976
```

Repeat this process until all the periods have been used, taking twice the part of the answer already found as a trial divisor.

1′53′76 (124., Ans.
1
22) 53
44
244) 976
976

If at any time the dividend, without the last figure, is less than the trial divisor, place a 0 as the next figure of the answer, and proceed as before.

Illustrations:

I. To find the square root of 822,649.

82′26′49. (907., Ans.
81
1807) 12649
12649

II. To find the square root of 28,900.

2′89′00. (170., Ans.
1
27) 189
189
0000

To find the square root of a number which contains a decimal, proceed as above, dividing the number into periods, starting at the decimal point and moving in both directions. All periods to the right of the decimal point must contain two figures and a 0 may be added to the last period if necessary.

Find the square root of the number, regardless of the decimal point. In the answer, point off as many places, beginning at the right, as there were periods to the right of the decimal point in the original number.

III. To find the square root of 414.9369.

```
            4'14 93'69(20.37, Ans.
            4
       403) 1493
            1209
      4067)  28469
             28469
```

IV. To find the square root of 8.71.

```
            8.71'00'00'00(2.9512, Ans
            4
        49)4 71
           4 41
       585)  30 00
             2925
               75 00
               5901
     59022)    1599 00
               118044
                41856
```

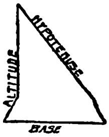
Observe that there is still a remainder and the process might be continued.

Written Exercises

Find the square roots of the following:

1 1728
2 289
3 576
4 12769
5 42849
6 3.61
7 2.4649
8 106.09
9 6.8121
10 364.81
11 341.
12 620
13 48.7
14 324.61
15 31.738

Square root is used in finding the length of the third side of a right-angled triangle, when the length of the other sides is known.



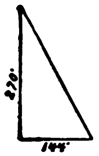
Notice that the longest side is called the hypothenuse.

The length of the hypothenuse = the square root of the sum of the squares of the other two sides.

The length of the base or altitude = the square *root of the* difference of the squares of the other *two sides.*

Illustrations:

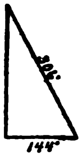
I. Find the hypothenuse: given, altitude = 270 ft., and base = 144 ft.



```
  144       270       72900       9'36'36'(306, Ans.
×144      ×270      +20736        9
  576     18900       93636    606)3636
 576      540                      3636
144       72900
20736
```

Hypothenuse = 306 ft., Ans.

II. Find the altitude: given, base = 144 ft., and hypothenuse = 306 ft.



```
  144       306       93636       7'29'00'(270
×144      ×306      -20736        4
  576      1836       72900     47)329
 576      918                      329
144       93636                     00
20736
```

Altitude = 270 ft., Ans.

Written Exercises

1 Given: altitude, 207; hypothenuse, 305. Find base.

2 Given: altitude, 203; base, 396. Find hypothenuse.

3 The diagonal of a rectangular field is 325 ft. long and one side of the field is 204 ft. long. How long is the other side?

4 In crossing a stream 33 ft. wide, a man swam 65 ft. How far was his landing place below his starting point?

5 A 45 ft. tree casts a 24 ft. shadow when the sun is at a certain height. How many feet is it from the top of the tree to the end of the shadow?

METRIC SYSTEM

Measures of Length

10 millimeters (mm.)	= 1 centimeter	— cm.	= .3937	in.
10 centimeters	= 1 decimeter	— dm.	= 3.937	in.
10 decimeters	= 1 meter	— m.	= 3.28	ft.
10 meters	= 1 dekameter	— Dm.	= 32.8	ft.
10 dekameters	= 1 hektometer	— Hm.	= 328.09	ft.
10 hektometers	= 1 kilometer	— Km.	= .62137	mi.
10 kilometers	= 1 myriameter	— Mm.	= 6.2137	mi.

Square Measure

100 square millimeters (sq. mm. or mm^2)	= 1 square centimeter	— sq. cm. or cm^2
100 square centimeters	= 1 square decimeter	— sq. dm. or dm^2
100 square decimeters	= 1 square meter or centare	— sq. m. or m^2 — ca.
100 square meters or 100 centares	= 1 square dekameter or are	— sq. Dm. or Dm^2 — A.
100 square dekameters or 100 ares	= 1 square hektometer or hektare	— sq. Hm. or Hm^2 — ha.
100 square hektometers 100 hektares	= 1 square kilometer	— Sq. Km. or km^2

Common Equivalents

1 sq. cm.	— 0.1550 sq. in.
1 sq. dm.	— 0.1076 sq. ft.
1 sq. m.	— 1.1960 sq. yd., 10.7637 sq. ft.
1 are	— 3.954 sq. rd.
1 hektare	— 2.471 A.
1 sq. Km.	— 0.3861 sq. mi.

Cubic Measure

1,000 cubic millimeters (cu. mm. or mm^3)	= 1 cubic centimeter	— cu. cm. or cm^3
1,000 cubic centimeters	= 1 cubic decimeter	— cu. dm. or dm^3
1,000 cubic decimeters	= 1 cubic meter	— cu. m. or m^3

Common Equivalents

1 cu. cm.	= .06102	cu. in.
1 cu. dm.	= 61.023	cu. in.
1 cu. m.	= 61,023.4	cu. in. = 35.3145 cu. ft. = 1.308 cu. yd.

In measuring wood, the cubic meter is called a stere.

Measures of Capacity

10 milliliters (ml.) = 1 centiliter — cl.
10 centiliters = 1 deciliter — dl.
10 deciliters = 1 liter — l.
10 liters = 1 dekaliter — Dl.
10 dekaliters = 1 hektoliter — Hl.
10 hektoliters = 1 kiloliter — Kl.
10 kiloliters = 1 myrialiter — Ml.

Common Equivalents

1 liter = 61.023 cu. in.
1 liter = 1.0567 liquid quarts
1 liter = 0.9078 dry quarts
1 hektoliter = 3.53144 cu. ft.
1 hektoliter = 26.417 gallons
1 hektoliter = 2.8378 bushels

Measures of Weight

10 milligrams (mg.) = 1 centigram — cg.
10 centigrams = 1 decigram — dg.
10 decigrams = 1 gram — g.
10 grams = 1 dekagram — Dg.
10 dekagrams = 1 hektogram — Hg.
10 hektograms = 1 kilogram, or kilo — Kg. or k
10 kilograms = 1 myriagram — Mg.
100 myriagrams = 1 tonneau, or ton — T.

Common Equivalents

1 gram = 1 cu. cm., or 1 ml. of water.
1 kilogram = 1 cu. dm., or 1 liter of water.
1 metric ton = 1 cu. m., or 1 kiloliter of water.
1 gram = 15.432 gr. Troy.
1 gram = 0.03527 oz. avoirdupois.
1 kilogram = 2.2046 lb. avoirdupois.
1 metric ton = 1.1023 tons of 2,000 lb.

Written Exercises

1 Find the area in square meters of a piece of land 4 dekameters long and 5 decimeters wide.

2 What will be the cost of a piece of cloth 18 meters long and 8 decimeters wide at 15¢ per square meter?

3 A cistern with a circular base 10 meters in diameter is 15 meters deep. How many liters of water will it hold?

4 How many pounds in 28 kilograms?

5 *How many* meters in 16 yards?

6 *How many* meters in 15 kilometers?

MISCELLANEOUS PROBLEMS

1 How many feet of wire are required to fence a garden 52 yd. long and 23 yd. wide, using 5 strands of wire?

2 Four commercial travelers leave the home office on Jan. 2, 1902, on circuits of 4, 8, 12 and 16 weeks' travel respectively. If they continue traveling every week, repeating their circuits, on what date will they all first meet again at the office?

3 Under the law the salary or compensation of postmasters at fourth-class offices consists of—

1 All box rents.

2 Commissions on the amount of postage due-stamps, ordinary postage stamps, stamped envelopes, postal cards, and newspaper and periodical stamps canceled on matter actually mailed at their offices, and on amounts received from sales of paper dead-newspapers, printed matter, and twine, at the following rates: on the first $50.00 or less, 100%; on the next $100.00 or less, 60%; on the next $200.00 or less, 50%; on the excess above $350.00, 40%. During the year a postmaster's account was as follows:

Quarter	Box-rent	Cancellation				Sales of Waste paper	Sales of Twine	Salary	
		2¢ stamps	1¢ stamps	Postal cards	Stamped envs.				
First	$89.00	$54.00	$22.50	$7.16	$52.00	$0.65	$3.84		
Second	63.00	73.45	14.90	8.17	38.54	.82	2.19		
Third	78.19	58.91	16.70	3.84	33.93	.94	4.48		
Fourth	68.75	72.36	13.82	7.95	49.71	.38	6.85		

What was his salary for each quarter? For the year?

4 A is at Jonesville and B is at Smithville, places that are 200 miles apart. A and B walk toward each other, A at the rate of 3½ miles per hour and B at the rate of 4½ miles per hour. How far from Smithville is the place where they meet and how far does A walk?

5 A grocer bought 28 bbl. flour at $4.90 a bbl. He sold 3/7 of *it as 3¢ a lb. and the* remainder at 3¼¢ a lb. How much did he *gain or lose?*

6 A works for $3 00 per day and B for $2.00. A can do a piece of work in 12 days and B can do the same piece of work in 15 days. How much will it cost to have the work done, A and B working together?

7 To five thousand and one hundred five millionths add four and sixteen thousandths.

8 Divide one hundred by three and one hundred twenty-five thousandths.

9 What will be the cost of carpeting a room 13 ft. long, 12 ft. wide, with carpet 1 yd. wide worth $1.15 per yard, with 10¢ per yard added for putting down?

10 If 13¼ yd. of cloth cost $26 50, how many yards can be bought for $315.35?

11 If ⅔ of a man's money is $400.00 less than 5/7 of it, how much has he?

12 A house which costs $5,000.00 rents for $25.00 a month and the owner pays 2 per cent on ⅗ of its value in taxes and $25.00 a year for repairs. What per cent does the house pay?

13 A piece of property pays a tax of $129.01, which is at the rate of $13.30 per thousand dollars. What is the value of the property?

14 A has a house lot 25 ft. wide and 30½ ft. deep that is worth $950.00. B has a lot 35 ft. wide and 28¾ ft. deep valued at the same price per foot. How much would A have to give with his lot to get B's lot?

15 Which gives the greater rate of income, and how much, 6% stock bought at 108 or 3½% stock bought at 62½?

16 A man sold a bill of goods for $384.00 by weights averaging 16½ oz. to a pound. He also sold at the same time goods for $288.00 by weights averaging 15¾ oz. to the pound. How much did he make or lose?

17 Add vertically and horizontally:

350656	626133	479277
192190	235191	246169
484482	879351	932715
136134	358084	968050
628320	293426	753071

18 What is the amount of Mr. Brown's tax bill, if he owns a house and a garden valued at $5,400.00; personal property valued at $2,000.00; and pays one poll tax of $2.00; the tax rate being $14.20?

19 A horse costing $250 was sold at a gain of 40%. For how much will the new owner have to sell in order to gain 18%?

20

$580\frac{50}{100}$ Buffalo, N. Y., Oct. 17, 1902.

On demand, after date, for value received, I promise to pay to the order of James H. Manning, five hundred eighty and $\frac{50}{100}$ dollars with interest at three per cent.

MAYNARD WHITING.

Settled April 5, 1904. How much was due?

21 A can do a piece of work in 10 days, B can do the same piece of work in 8 days. A works for $3.50 per day and B works for $4.00. Will I gain or lose by having A do it alone instead of having A and B do it together, and how much?

22 I bought a watch for $120.00 and sold it so that, after taking $12.00 from the asking price, I still gained 15% on the purchase. What per cent did I discount from the asking price?

23 What is the weight in tons of the water that fills a cistern 4 ft. 8 in. long, 3 ft. 10 in. wide and 5 ft. $3\frac{1}{2}$ in. deep, a cubic foot of water weighing 1,000 ounces? (1 ton = 2,240 lb.)

24 If a farmer gives $\frac{1}{12}$ of his grain for grinding, how much must he take to the mill in order to bring home 16 bu. 2 pk.?

25 Find the interest on $463.28 for 1 yr. 6 mo. 13 da. at 9%.

26 How many square feet are there in a triangular flower bed whose base is 18 ft. and whose perpendicular height is 9 ft.?

27 How many towels $\frac{1}{2}$ yd. long can be cut from $10\frac{1}{4}$ yd. and what part of a yard will be left?

28 A real estate broker who charges 5% commission receives $225.00 for selling a house and preparing the papers necessary for the transfer of the property. What price is paid for the house?

29 *A horse* was sold for $180.00 at a loss of 10%. What would *have been the* selling price if there had been a gain of 17%?

30 Two persons walk for 6 hr. 15 min., one at the rate of 4½ mi. per hour, and the other at the rate of 160 rd. in 7½ min. (a) If they have traveled in opposite directions how far apart are they? (b) If they have traveled in the same direction, how far apart are they?

31 In a mail of 100 pounds there are 800 letters that average 20 letters to the pound. The remainder of the mail is of papers that average 10 to the pound. How many papers are there?

32 To the difference between 86⅝ and 64 7/9 add the quotient of 62.5 divided by 12.4.

33 A harness weighs 1/30 as much as the wagon; the wagon weighs ¾ as much as the horses, and the horses weigh ½ as much as the load. If the harness weighs 75 lb. what is the entire weight of the team and load?

34 A certain piece of work can be done by A in 8 days, by B in 10 days and by C in 12 days. A works for $2.25, B for $1.75 and C for $1.50. How long will it take to do the work all laboring together and what is the cheapest price for which it may be done?

35 Multiply 3.098 by 84 1/25, and divide the product by 224.4. (Entire work to be done decimally.)

36 If a train travels 210 mi. in 8¼ hr. and goes at the rate of 28 mi. an hr., stopping 1¼ min. at each station, how many stops does it make?

37 Five registered letters, containing respectively, $165.00 $204.00, $178.00, $204.00 and $216.00, were rifled of their contents by a postal clerk. When arrested, he had $634.25 which an inspector was required to divide pro rata among the senders of the letters. What amount should he pay to each?

38 Seven boys picked together 16 bu., 2 pk., 3 qt. berries and sold them at 8¢ per qt. What was each boy's share?

39 Find the interest on $1,233.69 for 1 da. at 1%.

40

$1,248.00. Boston, Mass., Feb. 28, 1903.

On demand, after date, for value received, I promise to pay Owen & Cooper one thousand two hundred forty-eight dollars with interest at six per cent.

James W. Frothingham

Paid June 14, 1906. How much was due?

41 Find the sum of $\frac{1}{8}$; 7.5; 4.65; $3\frac{3}{8}$; $9\frac{1}{4}$; and $4\frac{5}{8}$; multiply this sum by $2\frac{3}{16}$; divide the product by 6 and from the quotient take one-third of itself.

42 If $\frac{9}{8}$ of a lb. of butter costs $\frac{2}{5}$ of a dollar, what will $5\frac{1}{4}$ lb. cost?

43 A contractor agrees to perform a piece of work requiring 30 men in 18 da. After working 8 da. his men strike and are out 4 da. How many additional men must he put on in order to finish the work in the required time?

44 A man earns $15.00 per week. His weekly expenses are as follows: room $3.00; meals $4.00; necessary incidentals, $3.50; amusements, one-half of the remainder. He saves what is left. What per cent of his earnings is spent for room, for meals, for necessary incidentals, and what per cent is saved?

45 Which is more economical for the buyer and how much, a direct discount of 30%, or successive discounts of 10%, 10% and 10%?

46 Add vertically and horizontally:

3671	92763	9281	417
476	1879	410	23
918	241	17306	96
364	9	1848	1176
11008	17698	613	238
1409	4123	9284	99

47 A post office clerk had an income of $840.00 a year. He spent $\frac{4}{7}$ of it for supplies on credit. Had he paid cash 83¢ would have bought $1.00 worth of goods. How much would he have saved by paying cash?

48 What must I invest in 5% stock at $88\frac{3}{4}$ to receive an annual income of $1,255.00, brokerage being $\frac{1}{8}$%?

49 In a certain mail there were 8,425 pieces to be sorted. A worked 45 min. when he was joined by B handling 36 pieces a min., and C handling 40 pieces a min. They all finished the mail in 58 min. How many pieces per min. did A handle the entire time?

50 A letter carrier travels 5 mi. to deliver his mail. He stops $\frac{1}{2}$ of the time at houses, takes 44 steps a minute while walking, each *step being* $2\frac{1}{2}$ *feet* long. How long does it take him to deliver *the mail?*

51 What is $87\frac{1}{2}\%$ of $2\frac{2}{7}$ bushels?

52 Find the interest on $814.00 for 1 yr., 6 mo., 27 da. at $4\frac{1}{2}\%$.

53 A pile of bricks is 10 ft. long, 8 ft. wide, and 6 ft. high. How many bricks in the pile, each brick being 8 in. long, 4 in. wide and 2 in. thick?

54 If a miller takes 1 bushel in 8 as his pay for grinding corn, how many bushels must a farmer take to mill to receive 63 bushels of corn to take home?

55 A man paid $980.00 for 280 boxes of oranges. He sold $\frac{5}{14}$ at a loss of $0.44 a box. For how much per box must he sell the remainder to clear $491.60 on the whole transaction?

56 If the premium for insuring a house for $\frac{4}{5}$ of its value at $\frac{3}{4}\%$ is $5.40, what is the loss to the owner if the house is wholly destroyed?

57 Write in words the number expressed by the following figures: $20,010,003\frac{42}{95}$.

58 Add these across, placing the total in the space indicated, then add the totals:

						Totals
16,385	8,534	19,653	30,016	29,868	14,464	
14,627	17,437	18,438	3,741	22,972	18,988	
13,206	67,433	34,965	12,674	32,905	3,726	
16,389	27,865	32,476	18,430	33,301	18,655	
15,826	18,866	24,069	18,865	13,796	24,397	

59 What is the duty on 986 yards of silk, invoiced at $1.10 a yard at 43% ad valorem?

60 A man bought 8 bu. berries for $20.56 and lost 24 qt. by decay. He then sold the rest for $12\frac{1}{2}$¢ a qt. Did he gain or lose and how much?

61 Simplify: $\frac{5}{36}$ of $\frac{144}{25} \times \frac{45}{9} \div \frac{11}{12}$ of $\frac{7}{9}$.

62 From a bin 7 ft. long, 5 ft. wide, and 4 ft. high, which was $\frac{3}{4}$ full of grain, 10 bags were filled, each bag containing 1 bu. 3 pk. How much remained in the bin?

63 How many three-inch cubical blocks can be packed in a box 2 ft. long, 1 ft. 3 in. wide, and 9 in. deep?

64 If I pay $31.75 for the use of $1,500.00 for 4 mo. 7 da., What is the rate per cent per year?

65 To the sum of 927$\frac{3}{4}$, 15$\frac{2}{3}$, and 79$\frac{1}{3}$, add the difference between 52$\frac{3}{8}$ and 79$\frac{2}{5}$.

66 A widow had $35,000.00 which was $\frac{7}{16}$ of an estate. The balance was equally divided among six children. How much did each receive and how much more did the widow have than each child?

67 A horse was sold so that $\frac{4}{5}$ of the gain equalled $\frac{2}{15}$ of the cost. What was the gain per cent?

68 A man owned $\frac{3}{4}$ of a lot of land valued at $38,000.00. He sold $\frac{17}{19}$ of his share for $\frac{4}{3}$ of its value. How much did he make by the transaction? (Use cancellation.)

69 From the product of 92.5 and 64.3, subtract the quotient of 183 divided by 24.5.

70 If 7 men can do a piece of work in 10$\frac{1}{2}$ days, how long will it take 8 men and 5 boys to do the same work, each boy doing $\frac{1}{2}$ as much as a man?

71 Find the sum of all the multiples of 9 from 27 to 252.

72 If I purchase at 95$\frac{3}{4}$, brokerage $\frac{1}{4}$%, a stock paying 6% dividends annually, what per cent does the investment yield?

73 A rectangular piece of land 317 ft. 4 in. long, and 126 ft. 6 in. wide is enclosed by a ditch 5 ft. wide and 3 ft. deep, the ditch being wholly outside the field. How many cubic yards of earth were removed?

4 Find the interest on $290.00 for 4 yr. 2 mo. 24 da. at 8%.

75 What is the length of the diagonal of a room whose dimensions are 30 × 20 × 10 feet?

76 How much will be received from the sale of 16 shares C., B. and Q. stock, at 103$\frac{5}{8}$, brokerage $\frac{1}{8}$%?

77 What is the length of a plank 1$\frac{1}{2}$ in. thick, 1 ft. 6 in. wide containing 36 board ft.?

78 A dealer put up 140,000 pounds of salt in 20 pound, 10 pound and 5 pound boxes, using the same number of each size. How many boxes of each size did he use?

79 How much will it cost to carpet a room 48 ft. long and 36 ft. wide, the strips being $\frac{3}{4}$ of a yard wide and running lengthwise the carpet costing 61$\frac{1}{2}$¢ a yd.?

80 A rectangular field 90 rods long and 49 rods wide is surrounded by a fence of matched boards 5 feet high. Find the cost of painting the fence at $18\frac{1}{2}$¢ a square yard.

81 Two men are 1,932 miles apart and travel toward each other, one at the rate of $52\frac{1}{3}$ miles per day, the other at the rate of $48\frac{1}{2}$ miles per day. How far apart are they at the end of 12 days?

82 A man's house, when valued at $3,720.00, was taxed on $\frac{2}{3}$ of its value; if he had to pay a tax of $14.00 on a thousand, what was his entire tax, including a poll tax of $2.00?

83 A man buys a piece of land 300 ft. square at $0.90 a sq. ft. After cutting a roadway through it 60 ft. wide, he sells the remainder at $1.47 a sq. ft. What is his gain?

84 How many sheets $2\frac{1}{2}$ yards in length can be cut from $26\frac{1}{4}$ yards of cloth and how many yards will be left?

85 What is the value of a pile of wood 36 ft. long, 4 ft. high, and 7 ft. wide, at $6.70 a cord?

86 A merchant bought goods for $5,500.00. He sold $\frac{11}{16}$ for $3,478.75 and the remainder for $\frac{3}{25}$ more than it (the remainder) cost him? How much did he lose?

87 What will it cost to floor a space $32\frac{1}{2}$ ft. long, and 26 ft. wide, with boards at $25.00 per M, allowing $\frac{1}{5}$ for sheathing and waste?

88 A tank is 6 ft. 5 in. long, 4 ft. wide and 24 in. deep. How many gallons does it contain?

89 Add: $\frac{25}{42}$ of $\frac{96}{1625}+\frac{14}{99}$ of $\frac{44}{7}$.

90 Having bought goods at 25% and 15% discount from the list price of $1,500.00, I sell them at 15%, 15%, and 10% from the same list price. Do I gain or lose and how much?

91 A tank is 10 ft. 6 in. long, 7 ft. 3 in. wide, and 6 ft. deep. What is its capacity in gallons?

92 How shall a father divide $3,124.00 among his five sons so that each may have one-third more than the one next older than himself?

93 After one-fourth of a barrel of oil had been sold to A, B bought 12 gallons, after which the barrel was found to be one-half full. How many gallons did it contain originally?

94 A stock of goods costing $15,600.00 was sold at a loss of 12½% and 15% of the selling price was in bad debts. What was the total loss?

95 Find the compound interest of $500.00 at 4% for 1 yr 9 mos. 12 da., interest being compounded semi-annually.

96 A man drew 15% of his deposit from a bank and with it paid a debt of $1,119.60. What balance was left in the bank?

97 A circular flower bed 20 ft. in diameter is surrounded by a walk 5 ft. wide. How many square feet of surface does the walk contain?

98 Find the interest on $560.00 from May 14, 1902 to Oct. 6, 1903 at 4½%.

99 A merchant failed, owing $27,984.00, with his assets amounting to $16,090.80. What per cent of his debts can he pay?

100 The following stock of postage stamps, stamped envelopes etc., was found on hand at Sedalia, Mo., post office at close of a quarter.

$$\left.\begin{array}{l}\text{39 sheets 1¢ stamps}\\ \text{28 sheets 2¢ stamps}\\ \text{43 sheets 4¢ stamps}\end{array}\right\}\text{100 stamps to each sheet.}$$

$$\left.\begin{array}{l}\text{67 sheets 10¢ stamps}\\ \text{27 sheets 15¢ stamps}\end{array}\right\}\text{50 stamps to each sheet.}$$

18 boxes 1¢ postal cards, 500 in each box.

14 boxes newspaper wrappers, 250 in each box at $11.00 per thousand.

13 boxes stamped envelopes, 500 in each box, and 375 envelopes (part of a box) at $21.80 per thousand.

State the total value of the stock.

101 Find the interest on $568.00 for 1 yr. 8 mo. 12 da. at 6%.

102 An agent receives $4,800.20 with which to buy flour at $5.50 per barrel, after paying a $200.00 freight bill and his commission of 2%. How many barrels did be buy?

103 Divide 20 apples between 2 children so that one may have two-thirds as many as the other.

104 A horse costing $250.00 was sold at a gain of 40%. For how much will the new owner have to sell in order to gain 18%?

105 Find the interest on $517.62 for 8 mo. at 7%.

106 490 hogs, $\frac{4}{7}$ of them weighing on an average 80 lb. and the remainder 72 lb., were sold at the rate of $4.50 per hundred lb. What was the selling price?

107 If I pay $36.00 for insuring my house for $\frac{2}{3}$ of its value at $1\frac{1}{4}$%, what is the value of the house?

108 A man bought 36 shares of stock at $110\frac{1}{2}$ and sold them at $117\frac{3}{4}$, brokerage $\frac{1}{8}$ on each transaction. What was his total gain?

109 Reduce to lowest terms: $\frac{435}{3567}$, $\frac{390}{494}$, $\frac{910}{2093}$.

110 What fraction multiplied by $2\frac{3}{8}$ equals $\dfrac{5\frac{1}{7}}{\frac{3}{10}}$?

111 What will be the cost of a strip of land for a road 66 ft wide and 2 mi. long, at $30.00 an acre?

112 Add the following:

205,945
106,549
549,502
274,032
567,485

From the sum subtract 45,789.

113 In 1900, Missouri's wheat crop was 429,288 bu. while that of Mississippi was 47,284 less than $\frac{1}{6}$ as much as that of Missouri. What was the Mississippi crop worth at $1.08 a bu.?

114 At a commission rate of $2\frac{1}{2}$%, an agent receives $208.00 What was the amount invested?

115 Multiply 3.094 by $84\frac{1}{25}$ and divide the product by 224.3. (Use decimals.)

116 Find the simple interest, the exact interest, and the compound interest (semi-annual) of $1,200.00 at 5% from May 15, 1902 to Mar. 6, 1904.

117 In a certain mail there are 294 lb. 14 oz., of newspapers weighing at the rate of 3 papers to 7 oz. How many papers are there in the mail?

118 In an importation of 675 long tons of railroad iron, each rail was 42 ft. long and weighed 72 lb. per linear yard Required *the number of rails?*

119 The receipts of a certain post office were $288,416.00 the first year and the expenses were $\frac{1}{4}$ of the receipts. The second year the receipts were $\frac{1}{8}$ greater than the first and the expenses were $\frac{1}{3}$ less. What was the net proceeds of the office the second year?

120 Find the interest on $350.00 for 3 yr. 4 mo. 18 da. at 4%.

121 There are 1,648 pieces of mail received daily in an office. For each postal card there are three papers and four letters. How many letters are received?

122 A train leaves Omaha for Denver at noon, traveling at the rate of 36 mi. an hour. Three hours later another train leaves Omaha for Denver, traveling at the rate of 48 mi. an hour and overtakes the first train at Station C. How far is Station C from Omaha?

123 Which investment of $39,928.00 will yield the larger income and how much larger, 6 per cent stock bought at $108\frac{1}{2}$ or 5 per cent stock at 92?

124 If a tree $20\frac{2}{3}$ feet high casts a shadow 13 feet long, how high is a tree that casts at the same time a shadow 78 feet long?

125 A and B own a tract of land. A sells $\frac{1}{3}$ and B sells $\frac{1}{4}$ of it, and what they have left is worth $708.00. What was the original tract worth?

126 Find the interest on $800.09 for 93 da. at $4\frac{1}{2}$%.

127 A grocer sold goods amounting to $352.00 by weights averaging $16\frac{1}{4}$ oz. to a pound. He afterwards sold to the same customers goods amounting to $320.00 by weights averaging $16\frac{1}{2}$ oz. to a pound. Did he make or lose by the false weights and how much?

128 Two houses were sold for $3600.00 each, one at a loss of 20% and the other at a gain of $\frac{1}{5}$. How much was gained or lost in the transaction?

129 Two men, A and B were 1,420 mi. apart and traveling *towards each other.* A walked $14\frac{1}{2}$ mi. and B $12\frac{2}{3}$ mi. a day. At *the end of $12\frac{1}{2}$* da. how far apart were they?

130 At $30.00 per M, what is the value of 7 timbers, 18 ft. long, 12 in. wide and 6 in. thick?

131 Add the following numbers: 74,756½; 63,439¼; 173,387⅘; $56{,}428\frac{14}{20}$; and $687\frac{13}{16}$. Subtract from their sum 96,520.

132 A man spent $156.75 for fuel in a year, $\frac{7}{11}$ of which he spent for wood at $4¾ a cord, and the remainder for coal at $5.70 a ton. How many more cords of wood did he burn than tons of coal?

133 Multiply 31.78 by 60⅕, and divide the product by 3¼.

134 What sum placed at interest at 4% will amount to $37,180.00 in 2 yr. 11 mo. and 27 da.?

135 To the product of 54.2 and .09 add the sum of 917,279,346 and (295 multiplied by .805).

136 A boy travels 60 mi. on a bicycle. He travels 6⅔ mi. an hour for 3 hours, and 5½ mi. an hour for the next 6 hours. How many miles has he still to travel?

137 Add the difference between 983⅞ and 796.5 to the quotient of 69.9 divided by 23.3.

138 The bean crop of Wisconsin for 1900 was 160,835 bu.; that of Maine was 120,560 bu.; the same year Michigan produced 16,555 bu. less than 6½ times as many bu. as both the other states. What was the value of Michigan's crop at $1.68 a bu.?

139 Twenty-six thousand feet, board measure, of 2-inch plank were sent to cover the roadway of a bridge 250 ft. long and 41 ft. wide. What per cent of the planking was wasted?

140 Find the interest on $345.00 for 2 yr. 6 mo. 6 da. at 3%.

141 If 5 be added to both terms of the fraction ⅞, will it increase or diminish the value of the fraction, and how much?

142 A rectangular field 66 rods long and 42 rods wide is enclosed by a board fence 5 ft. high. How much will it cost to paint it at 8½¢ per sq. yd.?

143 In a city there are 689 mail boxes, and there was collected in 30 days, 82,680 lb. of mail matter, averaging ½ oz. per piece. What was the average number of pieces collected from each box in 1 day?

144 *A house* was sold for $3,872.00 at a gain of 21%. Find cost

145 A man, sending a sum of money from Boston to New York, sent $\frac{2}{5}$ by one express company, $\frac{1}{3}$ by another, $\frac{1}{6}$ by means of a money order, and the rest, which was $24.00 more than $\frac{1}{15}$ of the whole, in a registered letter. What was the amount sent?

146 To the product of $195\frac{3}{13}$ and $4\frac{1}{3}$, add $\frac{1}{2}$ the quotient of 8,965.6 divided by $18\frac{1}{5}$.

147 A certain office received on one day 384 letters, 98 papers and 244 postals; on the next, 422 letters, 98 papers, and 179 postals; the letters averaged $\frac{1}{2}$ oz. each, and the papers $2\frac{1}{4}$ oz., and the postals 9 to an ounce. How many pounds of mail were received in the two days?

148 Multiply the number of feet in a mile by the number of square rods in an acre and divide the product by 84.48.

149 A man bought a house and paid $1,680.00 cash, which was $\frac{3}{7}$ of the total cost. He paid $\frac{3}{8}$ of the cost at a second payment, and the remainder at a third payment. What was the amount of the last payment?

150 Find the interest upon $294.00 for 1 yr. 4 mo. 24 da. at 8%.

151 A receives $3.15 for $7\frac{1}{2}$ hr. work per day. How much does he lose in a year if he comes in 15 min. late for 156 da. in a year, and double value of time is deducted?

152 In a certain office a clerk and a janitor each worked the same number of days in a year, and together earned $1,498.65. The daily wage of the clerk was $3.25 and of the janitor was $1.60. How much did each earn in the year?

153 Find the interest on $380.00 for 1 yr. 8 mo. 6 da. at 4%.

154 Express in words: 124,763. 320,101,001.00151.

Express in figures: Twenty-five thousand one hundred one and nine tenths. Four million, one hundred one thousand one, and one ten-thousandth.

155 Add the following, giving the sum below: 186,432,850; 42,721,624; 1,743,280,704; 642,852,466; 74,821,955; 6,808; 89,898; 42,696,435,347.

156 A railway mail clerk traveled 7.25 da. at the rate of 211.5 mi. per day. On his return trip he made the journey in 5 da. How many miles per day did he travel on his return trip?

157 Multiply 87⅗ by 7.09 and divide the product by 1,552.71. (Solve by decimals, give work in full.)

158 An agent bought 439 books at $3.75 each, and sold them for $4.90 each, but failed to collect for 19 books. His expenses were $195.00. How much did he gain or lose?

159 Find the interest upon $296.80 for 6 mo. 9 da. at 9%.

160 A mail clerk made the following purchases and in payment gave a twenty-dollar bill; 4 bu. 3 pk. wheat at $1.20 a bu., 14 lb. bacon at 16½¢, 9 bars soap at 6 for 25¢, one bag flour at $2.71. If the store-keeper gave the clerk only nickels, how many did he receive in change?

161 A clerk earned $660.00 for two years, and $\frac{4}{11}$ more the third year, saving $\frac{3}{20}$ of his salary each year. How much did he save in the three years?

162 Two pianos are sold for $360.00 each, one at a gain of 20%, and one at a loss of 20%. How much is gained or lost in the transaction?

163 A carrier makes 4 trips a day, traveling 24 blocks or squares each trip (12 going and 12 coming); to each block he takes 297 steps of 20 in. each. How many miles will he travel in one year, working 304 days?

164 To the quotient of 125 divided by 6¼, add the sum of 97.037 and 1,037⅔.

165 Find the interest upon $294.00 for 2 yr. 12 da. at 3%.

166 Find the interest upon $318.00 for 3 yr. 2 mo. 15 da. at 4½%.

167 Find the interest upon $130.00 for 3 yr. 4 mo. 3 da. at 7½%.

168 A clerk bought 96 A. of land for $5,625.00. He raised a crop of wheat averaging 24¾ bu. per A. and sold it at $0.87½ per bu. He paid for labor and seed $14.85, and other expenses $92.25, and then sold the land for $60.00 per A. How much did he gain?

169 A train runs from A to B, a distance of 210 mi. in 8¼ hours including 6 stops of 7½ min. each. What was the average rate while the train was in motion?

170 If a mail carrier uses 4 tickets every day, and, buying them at the rate of 6 for 25¢, pays $51.00 for tickets, how many days *does he work?*

171 Divide $64\frac{6}{25}$ by 35.33982 and subtract .286 from the quotient (Use decimals).

172 A certain mail weighed 306 lb. One-fourth of the weight consisted of packages averaging 6 oz. each, and the rest of letters averaging $\frac{1}{2}$ oz. each. How many packages and letters were there in the mail?

173 A train traveled 457 mi. in 11 hr. 30 min. The first 187 mi. were traveled at the rate of 34 mi. per hour. What was the rate in going the remainder of the distance?

174 A man paid $1,530.00 for sheep at $3.75 a head. $\frac{3}{34}$ of them died. At what price per head must he sell the rest to clear $218.40.

175 What is the smallest number that will contain 24, 42, and 57, without a remainder?

176 A farmer sold the same number of horses, cows, and sheep, the horses at $120.00, the cows at $45.00, and the sheep at $8.00 a head, and received $692.00. How many of each did he sell?

177 A silver dollar contains $412\frac{1}{2}$ grains, $\frac{9}{10}$ being pure silver. How many dollars can be made from 825 lb. of pure silver? (5,760 gr. equals 1 lb.)

178 Subtract the quotient of 1728 and 144 from their product.

179 A man exchanged 12 sheep at $3.00 a head, and 6 cows at $32.00 a head for land at $19.00 an acre. How many acres did he receive?

180 To the product of 146,751 and 11,374 add the sum of 6,341 and 71,357.

181 Multiply 3,215.72 by 14.07 and subtract 1,275.1007 from the result.

182 Add horizontally and vertically:

71,432	75,291	532,263
719	169,364	937,751
315,962	8,683	13,494
728,431	73,451	649,287
6,010	2,130	214,531

183 In a mail there are 1,400 pounds of letters and papers, of *which $\frac{3}{7}$ are letters.* There are 14 papers to a pound and 7 letters to every 4 ounces. If one postman can sort 16 letters a minute and 56 papers every 4 minutes, how long will it take five postmen to sort the above-named mail?

184 A note of $824.00, given Feb. 16, 1904, for 4 mo. with interest at 6%, was discounted April 10, at 7%. Find the proceeds.

185 How many rods long is a square field containing 90 acres?

186 Simplify: $\dfrac{4\frac{2}{3}}{9\frac{7}{8}}$

187 An agent received $2,371.50 to invest in flour at $6.20 per barrel, after taking out his commission of 2%. How many barrels did he buy?

188 Upon a note of $1,260.00, given May 13, 1905, with interest at 4%, $372.00 was paid July 6, 1906, and $814.20, Jan. 1, 1907. What was due July 1, 1907?

189 Find the compound interest (semi-annual) at 4% upon $185.00 for 1 yr. 10 mo. 15 da.

190 What does the insurance company lose by the total destruction of a $7,500.00 house, insured for $\frac{4}{5}$ of its value at $\frac{3}{4}$%?

191 Find the tax rate per $1,000.00 when Mr. Hunt pays $68.75 upon a house assessed for $5,500.

192 How many square feet are there in the surface of a box 6 ft. long, 3 ft. wide, and 2 ft. deep?

193 What is the length of the longest stick that can be put into the above-named box?

194 Which is the better rate of commission, $68.00 upon a sale of $54,400.00 or $85.00 upon a sale of $68,000.00?

195 How much greater is the compound interest upon $1,000.00 from July 12, 1906 to Feb. 14, 1908, than the simple interest for the same time, interest being compounded semi-annually, the rate in each case being six per cent?

196 What is the length of the longest rod that can be put into a cylindrical barrel 3 feet high and 18 inches in diameter?

197 How *much* does one save by going diagonally across a lot *120 feet long* and 80 feet wide?

198 Which is the better investment, and how much better, 8% stock bought at 136 or 7% stock bought at 105?

199 600 barrels of apples, bought at $2.80 per barrel, with a commission of 1½% added, will cost the buyer how much?

200 Which is better, and how much better, to buy goods for $268.75 net or with discounts of 20%, 10%, and 5% from a list price of $400.00?

201 What would be the cost in United States money of three pieces of silk each 10 meters long and 75 centimeters wide at 5 francs per square meter?

202 On Jan. 1, 1909, George Moore owed Harry Gray & Co., $41.60 on account. Jan. 4 he bought 7 kegs of nails at $2.50. Jan. 5, 1 hammer, $1.25, 1 saw, $1.90. Jan. 9, he paid $25.00 on account. Jan. 12, he worked for Harry Gray & Co., $3.00. Jan. 15, he bought 50 lb. finish nails at 3½¢. Jan. 16, he paid $10.00 on account. Jan. 19, he bought 2 doz. door sets at 60¢ each and gave Harry Gray & Co. a draft on Boston for $20.00, which they accepted at 2½% discount. Make an itemized statement of the above account as it should appear taken from the books of Harry Gray & Co., closing the account and bringing down the proper balance.

203 What is the tax on 100 gallons of spirits 102½% proof at $1.10 per gallon?*

204 A tank is in the form of the frustum of a cone with the diameter of its base 6 ft., diameter at the top 4 ft., and depth of 3 ft. How many gallons of water will it hold?**

205 A wholesale dealer purchased 1,000 bottles of medicine at 87½¢ per bottle. The Internal Revenue tax was 1⅛¢ per bottle. For how much must the medicine be sold per bottle to gain 10%, if the cost of selling was $13.75?

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*Internal Revenue taxes are levied on the number of proof gallons produced when the spirits are at or above 100% proof. To find the number of proof gallons multiply the number of wine gallons by the percentage of proof.

**To find the volume of the frustum of a cone multiply the sum of the squares of the radii of its bases, plus the product of the radii of its bases by one-third the depth by 3.1416.

SPECIMEN EXAMINATION PAPERS

Specimen examination papers for the position for which the candidate wishes to be examined, may be obtained, if a post office or custom house position, upon application to the United States Civil Service Commission, Washington, D. C., or, if a state position, upon application to the Civil Service Commission, State House, (Name of State).

ANSWERS.

Page 19.—1. XV. 2. XXI. 3. LXVII. 4. LXXXIV. 5. XC. 6. XIV. 7. LXXXIX. 8. CXXXV. 9. CCLXVII. 10. DCCCXXIV. 11. XXIII. 12. XLVI. 13. LXIX. 14. CCCXLIX. 15. CDLXXI. 16. XLIV. 17. LXXVII. 18. CDI. 19. DCCLXIV. 20. MCCLXXXV. 21. XLIX. 22. DXXIV. 23. CMLX. 24. MCCCLXXIX. 25. MMCDXCIV. 26. XCIX. 27. MXVI. 28. MDCCCXII. 29. MMCMXIX. 30. MMCDXLIX. 31. CIV. 32. MDCCCLXI. 33. MCCLXXXV. 34. MCMIX. 35. $\overline{\text{X}}$CXXVI. 36. CDXLIX. 37. MDCCLXXVI. 38. MDCXIX. 39. $\overline{\text{X}}$CCCLXXXIX. 40. $\overline{\text{X}}$MCXI. 41. CMXCVI. 42. MDCVII. 43. $\overline{\text{X}}$MMCCCXLV. 44. $\overline{\text{X}}$MCDLXXII. 45. $\overline{\text{X}}$CMXCIII. 46. DLXVII. 47. MCDXCII. 48. MCMIV. 49. MMCMXCVI. 50. $\overline{\text{X}}$CCCCXLIII. 51. DCCCLXXIII. 52. CDLXII. 53. MCMVI. 54. $\overline{\text{X}}$MMCDXLIV. 55. $\overline{\text{X}}$CMXLIX. 56. MCMXXXII. 57. MMMCDXLIV. 58. MMCMXCIX. 59. $\overline{\text{X}}$MCMXVI. 60. $\overline{\text{M}}\overline{\text{D}}\overline{\text{V}}$CDXCII.

Page 21.—1. 94,027. 2. 97,080. 3. 323,634. 4. 344,104. 5. 492,429. 6. 1,171,024. 7. 2,695,229. 8. 96,411. 9. 74,173. 10. 134,407.

Page 23.—1. 6620.45696. 2. 2488.88738. 3. 12.38275. 4. 162.86965. 5. 1057.26405. 6. 64.485 A. 7. 1458.526 mi

Page 24.—1. $27389.9535. 2. $33159.40. 3. $2880.87. 4. $63.65. 5. $6176.02. 6. $49.75. 7. $206.73. 8. $8754.00. 9. $13.28. 10. $1625.24.

Page 27.—1. $\frac{1}{4}$. 2. $\frac{1}{6}$. 3. $\frac{7}{8}$. 4. $\frac{5}{6}$. 5. $\frac{3}{4}$. 6. $\frac{1}{3}$. 7. $\frac{1}{8}$. 8. $\frac{11}{17}$. 9. $\frac{3}{4}$. 10. $\frac{1}{5}$. 11. $\frac{3}{35}$. 12. $\frac{2}{3}$. 13. $\frac{11}{12}$. 14. $\frac{14}{25}$. 15. $\frac{10}{31}$. 16. $\frac{3}{4}$. 17. $\frac{2}{5}$. 18. $\frac{3}{8}$. 19. $\frac{34}{55}$. 20. $\frac{18}{37}$. 21. $\frac{23}{25}$. 22. $\frac{2}{3}$. 23. $\frac{19}{27}$. 24. $\frac{1}{8}$. 25. $\frac{9}{17}$. 26. $\frac{2}{3}$. 27. $\frac{5}{6}$. 28. $\frac{5}{9}$. 29. $\frac{9}{10}$. 30. $\frac{7}{19}$.

Page 28.—1. $\frac{32}{57}$. 2. $\frac{13}{16}$. 3. $\frac{7}{8}$. 4. $\frac{29}{37}$. 5. $\frac{107}{117}$. 6. $\frac{3}{16}$. 7. $\frac{4}{5}$. 8. $\frac{374}{361}$. 9. $\frac{25}{16}$. 10. $\frac{17}{19}$. 11. $\frac{4}{9}$. 12. $\frac{7}{9}$. 13. $\frac{11}{12}$. 14. $\frac{13}{11}$. 15. $\frac{23}{27}$. 16. $\frac{12}{17}$. 17. $\frac{13}{19}$. 18. $\frac{689}{1715}$. 19. $\frac{11}{12}$. 20. $\frac{71}{193}$. 21. $\frac{39}{41}$. 22. $\frac{329}{703}$. 23. $\frac{13}{21}$. 24. $\frac{273}{323}$. 25. $\frac{7}{9}$. 26. $\frac{14}{23}$. 27. $\frac{41}{47}$. 28. $\frac{7}{8}$. 29. $\frac{373}{503}$. 30. $\frac{19}{20}$.

Page 29.—1. $55\frac{7}{16}$. 2. $12\frac{16}{19}$. 3. $116\frac{2}{19}$. 4. 2. 5. $1\frac{54}{379}$. 6. $7\frac{2}{17}$. 7. $82\frac{10}{27}$. 8. $5\frac{154}{359}$. 9. $4\frac{8}{13}$. 10. 11. 11. $22\frac{1}{28}$. 12. $82\frac{8}{31}$. 13. $22\frac{13}{16}$. 14. $53\frac{15}{23}$. 15. $39\frac{1}{4}$. 16. $82\frac{26}{29}$. 17. $34\frac{19}{31}$. 18. $59\frac{4}{37}$. 19. $772\frac{6}{11}$. 20. $454\frac{21}{47}$. 21. $202\frac{5}{13}$. 22. $277\frac{13}{18}$. 23. $174\frac{7}{15}$. 24. $262\frac{1}{9}$. 25. $17\frac{6}{385}$. 26. $153\frac{2}{3}$. 27. $66\frac{31}{85}$. 28. $32\frac{182}{211}$. 29. $95\frac{9}{85}$. 30. $284\frac{9}{13}$. 31. $7\frac{109}{227}$. 32. $2120\frac{1}{33}$. 33. 1288. 34. $43\frac{29}{31}$. 35. $121\frac{78}{81}$. 36. $81\frac{3}{76}$. 37. $174\frac{1}{21}$. 38. $19\frac{22}{107}$. 39. $358\frac{1}{9}$. 40. $99\frac{7}{8}$.

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Page 30.—**1.** $\frac{970}{13}$. **2.** $\frac{2039}{18}$. **3.** $\frac{5168}{25}$. **4.** $\frac{1381}{16}$. **5.** $\frac{6991}{20}$. **6.** $\frac{12007}{80}$. **7.** $\frac{2147}{14}$. **8.** $\frac{6901}{274}$. **9.** $\frac{4942}{61}$. **10.** $\frac{4743}{23}$. **11.** $\frac{1628}{13}$. **12.** $\frac{12463}{31}$. **13.** $\frac{5975}{11}$. **14.** $\frac{8739}{13}$. **15.** $\frac{31775}{52}$. **16.** $\frac{10490}{29}$. **17.** $\frac{16236}{53}$. **18.** $\frac{14171}{25}$. **19.** $\frac{9337}{33}$. **20.** $\frac{25301}{28}$. **21.** $\frac{16579}{38}$. **22.** $\frac{11399}{16}$. **23.** $\frac{6697}{19}$. **24.** $\frac{8198}{29}$. **25.** $\frac{18803}{31}$. **26.** $\frac{7747}{13}$. **27.** $\frac{2330}{11}$. **28.** $\frac{1974}{17}$. **29.** $\frac{2497}{15}$. **30.** $\frac{14332}{23}$. **31.** $\frac{14281}{21}$. **32.** $\frac{2192}{17}$. **33.** $\frac{1851}{8}$. **34.** $\frac{12999}{16}$. **35.** $\frac{10187}{32}$. **36.** $\frac{1961}{16}$. **37.** $\frac{8542}{47}$. **38.** $\frac{169645}{152}$. **39.** $\frac{40943}{30}$. **40.** $\frac{97958}{75}$.

Page 32.—**1.** $1\frac{4}{5}$. **2.** $1\frac{5}{9}$. **3.** $4\frac{5}{8}$. **4.** $3\frac{1}{3}$. **5.** $2\frac{3}{5}$. **6.** $2\frac{11}{12}$. **7.** $4\frac{3}{10}$. **8.** $7\frac{2}{9}$. **9.** $2\frac{3}{8}$. **10.** $3\frac{11}{20}$ **11.** $1\frac{1}{32}$. **12.** $5\frac{3}{8}$. **13.** $2\frac{1}{14}$. **14.** $2\frac{79}{90}$. **15.** $2\frac{1}{12}$. **16.** $1\frac{4}{5}$. **17.** $3\frac{7}{16}$. **18.** $4\frac{8}{9}$. **19.** $7\frac{3}{4}$. **20.** $2\frac{19}{20}$. **21.** $3\frac{7}{8}$. **22.** $5\frac{13}{15}$. **23.** $3\frac{19}{28}$. **24.** $3\frac{3}{8}$. **25.** $4\frac{1}{9}$. **26.** $5\frac{19}{20}$. **27.** $4\frac{16}{45}$. **28.** $2\frac{13}{14}$. **29.** $4\frac{43}{48}$. **30.** $5\frac{24}{25}$. **31.** $6\frac{1}{8}$. **32.** $3\frac{23}{27}$. **33.** $3\frac{5}{6}$. **34.** $3\frac{5}{12}$. **35.** $3\frac{11}{16}$. **36.** $5\frac{22}{25}$. **37.** $4\frac{19}{72}$. **38.** $2\frac{8}{25}$. **39.** $6\frac{61}{80}$. **40.** $5\frac{4}{5}$.

Page 33.—**1.** $1\frac{57}{112}$. **2.** $\frac{907}{1260}$. **3.** $1\frac{73}{90}$. **4.** $\frac{29}{35}$. **5.** $1\frac{21}{22}$. **6.** $1\frac{41}{72}$. **7.** $1\frac{61}{120}$. **8.** $\frac{13}{20}$. **9.** $\frac{5}{24}$. **10.** $3\frac{43}{66}$. **11.** $2\frac{109}{168}$. **12.** $\frac{71}{72}$. **13.** $\frac{157}{240}$. **14.** $1\frac{1}{6}$. **15.** $2\frac{121}{234}$. **16.** $1\frac{31}{42}$. **17.** $2\frac{61}{140}$. **18.** $\frac{137}{176}$. **19.** $1\frac{29}{117}$. **20.** $\frac{131}{204}$. **21.** $2\frac{5}{36}$. **22.** $2\frac{107}{140}$. **23.** $1\frac{29}{960}$. **24.** $\frac{1642}{2475}$. **25.** $\frac{1531}{1680}$. **26.** $2\frac{5}{168}$. **27.** $1\frac{101}{216}$. **28.** $2\frac{29}{360}$. **29.** $1\frac{3}{8}$. **30.** $2\frac{17}{280}$. **31.** $1\frac{92}{153}$. **32.** $1\frac{5}{144}$. **33.** $3\frac{79}{180}$. **34.** $1\frac{445}{756}$. **35.** $2\frac{449}{720}$. **36.** $1\frac{61}{108}$. **37.** $1\frac{471}{560}$. **38.** $\frac{71}{72}$. **39.** $2\frac{73}{336}$. **40.** $1\frac{5}{21}$. **41.** $1\frac{11}{12}$. **42.** $2\frac{13}{120}$ lb. **43.** $2\frac{23}{72}$. **44.** $1\frac{31}{40}$ da. **45.** $4\frac{47}{144}$.

Page 35.—**1.** $12\frac{79}{90}$. **2.** $26\frac{81}{154}$. **3.** $12\frac{65}{112}$. **4.** $46\frac{59}{72}$. **5.** $48\frac{31}{126}$. **6.** $40\frac{65}{66}$. **7.** $44\frac{109}{168}$. **8.** $17\frac{19}{72}$. **9.** $25\frac{107}{240}$. **10.** $46\frac{7}{60}$. **11.** $13\frac{11}{20}$. **12.** $41\frac{7}{51}$. **13.** $500\frac{67}{153}$. **14.** $268\frac{361}{756}$. **15.** $498\frac{5}{14}$. **16.** $985\frac{1}{12}$. **17.** $821\frac{113}{280}$. **18.** $1135\frac{25}{117}$. **19.** $160\frac{137}{204}$. **20.** $548\frac{17}{180}$. **21.** $41\frac{7}{9}$. **22.** $35\frac{11}{24}$. **23.** $58\frac{5}{153}$. **24.** $43\frac{71}{108}$. **25.** $148\frac{43}{140}$. **26.** $10\frac{551}{1080}$. **27.** $40\frac{5}{16}$. **28.** $152\frac{491}{560}$. **29.** $699\frac{811}{960}$. **30.** $117\frac{347}{360}$. **31.** $831\frac{53}{60}$. **32.** $824\frac{23}{432}$. **33.** $2005\frac{1}{36}$. **34.** $535\frac{5}{168}$. **35.** $201\frac{145}{756}$. **36.** $231\frac{7}{12}$. **37.** $115\frac{393}{560}$. **38.** $4001\frac{39}{56}$. **39.** $198\frac{449}{720}$. **40.** $408\frac{229}{252}$. **41.** $\$112\frac{1}{2}$. **42.** $\$7\frac{7}{8}$. **43.** $8\frac{11}{40}$ A. **44.** $\$107\frac{3}{20}$. **45.** $\$92\frac{19}{100}$. **46.** $6\frac{5}{144}$ A.

Page 38.—**1.** 2181 pt. **2.** 10519 pt. **3.** 414 gi. **4.** 2595 gi. **5.** 28816 lb. **6.** 5655 oz. **7.** 11760 gr. **8.** 12554 ft. **9.** 13287 in. **10.** 19018 sq. in. **11.** $251.923\frac{1}{4}$ sq. ft. **12.** 161,704 cu. in. **13.** 2650 sheets. **14.** 18077 min. **15.** 101 bu. 4 qt. 1 pt. **16.** 15 hhd. 42 gal. 1 pt. **17.** 9 T. 9 cwt. 90 lb. 9 oz. **18.** 33 lb. 4 oz. **19.** 1 mi. 64 rd. 3 yd. 2 ft. 6 in. **20.** 2 sq. rd. 11 sq. yd. 4 sq. ft. 6 sq. in. **21.** 2 cu. yd. 13 cu. ft. 1344 cu. in. **22.** 18 reams 13 quires 12 sheets. **23.** 7 hr. 3 min. 34 sec. **24.** 1 mi. 308 rd. 2 yd. 2 ft. **25.** 5 sq. yd. 1 sq. ft. 104 sq. in. **26.** $1\frac{15407}{63360}$ mi. **27.** $1\frac{1801}{14520}$ A. **28.** $7\frac{83}{128}$ cd. **29.** $1\frac{227}{252}$ hhd. **30.** 318 pt. **31.** $7\frac{13}{36}$ bu. **32.** $37\frac{31}{77}$ gal. **33.** 500 bu. **34.** 1 lb. 286 gr. **35.** $42\frac{1}{2}$ gr. **36.** 1,468,800 sec. **37.** $26\frac{2}{7}$ wk. **38.** $2\frac{1}{12}$ reams. **39.** 56,250 lb. **40.** $103\frac{3}{4}$ mi. **41.** $\frac{43}{198}$ rd. **42.** $\frac{191}{729}$ *cu. yd.* **43.** $\frac{1021}{2160}$ da. **44.** $\frac{29}{108}$ sq. yd. **45.** $\frac{1603}{7920}$ mi. **46.** $\frac{43}{432}$ *cu. ft.* **47.** $\frac{63}{64}$ bu. **48.** .5704+ bbl. **49.** .062+ *circum.* **50.** .638+ gross.

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Page 40.—**1.** 354 bu. 2 pk. 7 qt. 1pt. **2.** 11 gal. 2 qt. 2 gi. **3.** 31 T. 4 cwt. 55 lb. 4 oz. **4.** 46 mi. 312 rd. 2 yd. 9 in. **5.** 84 A. 3 sq. rd. 27 sq. yd. 5 sq. ft. 28 sq. in. **6.** 19 cd. 7 cd. ft. 12 cu. ft. 27 cu. in. **7.** 16 hhd. 37 gal. 3 qt. 1 pt. 1 gi. **8.** 10 lb. 11 oz. 11 pwt. 15 gr. **9.** 90 da. 21 hr. 27 min. 37 sec. **10.** 32 rd. 4 yd. 2 ft. 5 in.

Page 41.—**1.** 8,927,785. **2.** 934,475. **3.** 77,388. **4.** 444,087. **5.** 385,593. **6.** 21,068 lb. **7.** 708,462. **8.** 187,871 ft. **9.** 411,403 people. **10.** 94,698 letters. **11.** 1,176,484 gal. **12.** $354,188. **13.** 66,711 lb. **14.** 17,384,118. **15.** 1,172,585. **16.** 1,125,058. **17.** 242,641. **18.** 126,648. **19.** 43,211. **20.** 17,772 lb.

Page 43.—**1.** 450.0009. **2.** 413.178. **3.** 8182.8385. **4.** 436999.999563. **5.** 369.9522. **6.** 379.7966 A. **7.** 40.399484. **8.** 666.556. **9.** 13,007.84996. **10.** 5.6268 mi. **11.** 127.864742. **12.** 332999.667. **13.** 29.8625 mi. **14.** 30.484 mi. **15.** 75.45992. **16.** 1.000517.

Page 44.—**1.** $553.175. **2.** $106.908. **3.** $969.75. **4.** $899.10. **5.** $30.02. **6.** $125.11. **7.** $148.25. **8.** $285.45. **9.** $1070.24. **10.** $622.16.

Page 45.—**1.** 4 lb. 8 oz. 19 pwt. 1 gr. **2.** 2 lb. 9 ℥. 2 ʒ. **3.** 3 mi. 37 rd. 5 yd. 7 in. **4.** 5 gal. 1 qt. **5.** 121.44 rd. **6.** 3 da. 13 hr. 48 min. **7.** 77 rd. 2 yd. 9 in. **8.** $\frac{21}{40}$ qt. **9.** 30 gal. 1 qt. **10.** 31 gal. 3 qt. 1 pt.

Page 47.—**1.** $\frac{29}{48}$. **2.** $\frac{11}{24}$. **3.** $\frac{26}{45}$. **4.** $\frac{59}{90}$. **5.** $\frac{17}{60}$. **6.** $\frac{5}{9}$. **7.** $\frac{19}{54}$. **8.** $\frac{1}{21}$. **9.** $\frac{11}{39}$ **10.** $\frac{37}{52}$. **11.** $\frac{23}{80}$. **12.** $\frac{4}{15}$. **13.** $\frac{1}{12}$. **14.** $\frac{1}{18}$. **15.** $\frac{4}{55}$. **16.** $\frac{25}{96}$. **17.** $\frac{5}{72}$. **18.** $\frac{11}{72}$. **19.** $\frac{1}{24}$. **20.** $\frac{1}{60}$. **21.** $\frac{37}{132}$. **22.** $\frac{1}{10}$. **23.** $\frac{31}{90}$. **24.** $\frac{43}{66}$. **25.** $\frac{41}{72}$. **26.** $\frac{7}{30}$. **27.** $\frac{9}{35}$. **28.** $\frac{1}{54}$. **29.** $\frac{1}{18}$. **30.** $\frac{5}{48}$. **31.** $\frac{13}{75}$. **32.** $\frac{3}{10}$. **33.** $\frac{7}{60}$. **34.** $\frac{1}{51}$. **35.** $\frac{67}{160}$. **36.** $\frac{4}{105}$. **37.** $\frac{271}{625}$. **38.** $\frac{2}{25}$. **39.** $\frac{108}{225}$. **40.** 0.

Page 48.—**1.** $\frac{37}{51}$. **2.** $\frac{41}{80}$. **3.** $\frac{3}{14}$. **4.** $\frac{15}{56}$. **5.** $\frac{38}{77}$. **6.** $\frac{9}{42}$. **7.** $\frac{29}{72}$. **8.** $\frac{17}{90}$. **9.** $\frac{41}{192}$. **10.** $\frac{79}{225}$. **11.** $\frac{23}{56}$. **12.** $\frac{73}{117}$. **13.** $\frac{29}{176}$. **14.** $\frac{19}{98}$. **15.** $\frac{11}{20}$. **16.** $\frac{5}{66}$. **17.** $\frac{49}{195}$. **18.** $\frac{49}{120}$. **19.** $\frac{26}{75}$. **20.** $\frac{71}{240}$. **21.** $\frac{173}{250}$. **22.** $\frac{95}{189}$. **23.** 0. **24.** $\frac{57}{140}$. **25.** $\frac{31}{84}$. **26.** $\frac{8}{45}$. **27.** $\frac{13}{24}$ yd. **28.** $\frac{7}{48}$ mi. **29.** $\frac{11}{18}$. **30.** $\frac{17}{108}$.

Page 49.—**1.** $4\frac{1}{9}$. **2.** $3\frac{1}{2}$. **3.** $5\frac{3}{10}$. **4.** $10\frac{1}{2}$. **5.** $7\frac{1}{12}$. **6.** $9\frac{2}{3}$. **7.** $\frac{2}{5}$. **8.** $18\frac{7}{12}$. **9.** $11\frac{22}{35}$. **10.** $6\frac{95}{96}$. **11.** $36\frac{13}{48}$. **12.** $31\frac{37}{44}$. **13.** $24\frac{65}{88}$. **14.** $30\frac{1}{16}$. **15.** $6\frac{9}{50}$. **16.** $13\frac{19}{32}$. **17.** $5\frac{37}{108}$. **18.** $2\frac{83}{105}$. **19.** $8\frac{19}{20}$. **20.** $14\frac{219}{320}$. **21.** $25\frac{1}{24}$ yd. **22.** $12\frac{13}{24}$ yd. **23.** $$2\frac{3}{8}$. **24.** $\frac{23}{24}$ A. **25.** $15\frac{7}{18}$ A. **26.** $$28\frac{7}{20}$.

Page 51.—**1.** 1,868. **2.** 8,960. **3.** 105,032. **4.** 239,904. **5.** 816,849. **6.** 23,848,204. **7.** 160,534,584. **8.** 127,704,621 **9.** 424,496. **10.** 6,717,990. **11.** 1,562,082. **12.** 66,304. **13.** 24,824,096. **14.** 3,986,100. **15.** 35,854. **16.** 3,176,500. **17.** 457,189,278. **18.** 712 673. **19.** 8,137,368. **20.** 172,238,724. **21.** 55,544,445. **22.** 8,477,805. **23.** 41,212,548. **24.** 60,593,228. **25.** 1,535,898. **26.** 13,920,930. **27.** 36,705,000. **28.** 14,245,738,884. **29.** 16,816,267,270. **30.** *143,408,472,143.* **31.** $26,792. **32.** 16,400 bu. **33.**

23,550 gal. **34.** 2,098,418 words. **35.** 390,720 ft. **36.** 69,058 lb. **37.** 121,728 lb. **38.** 19,530,560 lb. **39.** 59,563 words. **40.** 196,000 lb.

Page 53.—**1.** 81.016. **2.** 9.496617. **3.** 60.13407. **4.** 6.5456848. **5.** .000619056. **6.** 261.26764924. **7.** .294015. **8.** 11196.27. **9.** 625. **10.** 4. **11.** 40002.0240012. **12.** 320.216. **13.** 2377.38925.bu. **14.** 187.1775 mi. **15.** 402.530337 mi. **16.** 271.234795 A. **17.** 64609.91502 sq. yd. **18.** 3.820155 mi. **19.** 23.459618 A. **20.** 3348.770232 gal.

Page 55.—**1.** $843.875. **2.** $28624.428. **3.** $73615039.644. **4.** $61570. **5.** $34.3575. **6.** $515.90. **7.** $911.825. **8.** $44.375. **9.** $1625.40. **10.** $6.1975. **11.** 1st lot $84.70 more. **12.** $265.60. **13.** $2835. **14.** $1071. **15.** $86.94. **16.** $172.55. **17.** $11.25. **18.** $3834.1875. **19.** $1687.875. **20.** $334.7575.

Page 57.—**1.** $1\frac{2}{3}$. **2.** $6\frac{3}{10}$. **3.** 12. **4.** $19\frac{1}{4}$. **5.** $4\frac{5}{7}$. **6.** $36\frac{12}{13}$. **7.** $13\frac{10}{11}$. **8.** 39. **9.** $12\frac{3}{8}$. **10.** $6\frac{9}{23}$. **11.** $17\frac{7}{25}$. **12.** $10\frac{2}{13}$. **13.** $7\frac{7}{24}$. **14.** $8\frac{1}{18}$. **15.** $3\frac{11}{15}$. **16.** $29\frac{19}{24}$. **17.** $33\frac{11}{16}$. **18.** $17\frac{13}{22}$. **19.** $6\frac{12}{25}$. **20.** $66\frac{4}{15}$. **21.** $8\frac{16}{43}$. **22.** $22\frac{11}{15}$. **23.** $4\frac{2}{25}$. **24.** $200\frac{10}{13}$. **25.** $163\frac{17}{21}$. **26.** $289\frac{5}{11}$. **27.** $4\frac{11}{58}$. **28.** $401\frac{8}{17}$. **29.** $31\frac{23}{53}$. **30.** $114\frac{19}{23}$. **31.** 4\frac{1}{2}$. **32.** 2\frac{1}{10}$ **33.** 10\frac{1}{2}$. **34.** $28. **35.** $9 $\frac{9}{16}$. **36.** $98. **37.** $15\frac{7}{12}$ lb. **38.** $21\frac{15}{16}$ mi. **39.** $239\frac{1}{25}$ yd. **40.** 413 yd.

Page 58.—**1.** $\frac{3}{5}$. **2.** $\frac{1}{4}$. **3.** $\frac{7}{13}$. **4.** $\frac{1}{3}$. **5.** $\frac{2}{23}$. **6.** $\frac{10}{17}$. **7.** $\frac{18}{23}$. **8.** $\frac{24}{95}$. **9.** $\frac{8}{39}$. **10.** $\frac{1}{2}$. **11.** $2\frac{1}{4}$. **12.** $\frac{1}{20}$. **13.** $\frac{1}{18}$. **14.** $\frac{1}{9}$. **15.** $\frac{1}{9}$. **16.** $\frac{1}{36}$. **17.** $\frac{2}{9}$. **18.** $\frac{1}{52}$. **19.** $\frac{1}{6}$. **20.** $\frac{9}{16}$. **21.** $\frac{8}{13}$. **22.** $\frac{2}{45}$. **23.** $\frac{1}{21}$. **24.** $\frac{1}{6}$. **25.** $\frac{1}{18}$. **26.** $\frac{1}{12}$. **27.** $\frac{1}{8}$. **28.** $\frac{1}{102}$. **29.** $\frac{1}{8}$. **30.** $\frac{1}{4}$. **31.** $$\frac{7}{10}$. **32.** $$\frac{9}{40}$. **33.** $$\frac{2}{5}$. **34.** $$\frac{21}{100}$. **35.** $$\frac{143}{800}$. **36.** $\frac{13}{22}$. **37.** $$\frac{21}{44}$. **38.** $\frac{55}{192}$. **39.** $\frac{1}{5}$. **40.** $\frac{17}{27}$

Page 59.—**1.** 150. **2.** 86. **3.** 383. **4.** $93\frac{3}{5}$. **5.** $87\frac{1}{2}$. **6.** $214\frac{1}{2}$. **7.** $166\frac{2}{3}$. **8.** $262\frac{1}{2}$. **9.** $933\frac{1}{3}$. **10.** $137\frac{1}{2}$. **11.** $477\frac{7}{9}$. **12.** $1693\frac{3}{4}$. **13.** 726. **14.** $258\frac{5}{9}$. **15.** $224\frac{1}{5}$. **16.** 4884. **17.** 1005. **18.** $1177\frac{1}{2}$. **19.** $725\frac{1}{7}$. **20.** 1460. **21.** $3718\frac{1}{3}$. **22.** $802\frac{7}{16}$. **23.** $717\frac{1}{2}$. **24.** $672\frac{4}{9}$. **25.** $422\frac{4}{7}$. **26.** $1110\frac{3}{8}$. **27.** $6750\frac{2}{3}$. **28.** $17274\frac{8}{15}$. **29.** $16112\frac{25}{29}$. **30.** $39530\frac{34}{41}$. **31.** 1.72\frac{1}{2}$. **32.** 113\frac{3}{4}$. **33.** 48.93\frac{3}{4}$. **34.** $130\frac{2}{3}$ hr. **35.** 3399 cu. in. **36.** 2014 oz. **37.** $2.80. **38.** $11.41. **39.** 38940 ft. **40.** $82\frac{4}{5}$ mi.

Page 60.—**1.** $9\frac{1}{3}$. **2.** $39\frac{1}{3}$. **3.** $11\frac{11}{15}$. **4.** $30\frac{22}{45}$. **5.** $50\frac{53}{88}$. **6.** $87\frac{2}{7}$. **7.** $108\frac{8}{9}$. **8.** $21\frac{9}{14}$. **9.** $112\frac{7}{24}$. **10.** $220\frac{5}{18}$. **11.** $371\frac{1}{4}$. **12.** $403\frac{1}{10}$. **13.** $358\frac{3}{4}$. **14.** $268\frac{4}{21}$. **15.** 255. **16.** $211\frac{1}{20}$. **17.** $414\frac{2}{7}$. **18.** $465\frac{5}{18}$. **19.** $688\frac{27}{40}$. **20.** $292\frac{13}{24}$. **21.** $468\frac{26}{63}$. **22.** $225\frac{3}{11}$. **23.** $101\frac{5}{56}$. **24.** $349\frac{35}{54}$. **25.** $921\frac{27}{56}$. **26.** $1693\frac{37}{48}$. **27.** $473\frac{23}{24}$. **28.** $846\frac{3}{10}$. **29.** $2093\frac{23}{49}$. **30.** $892\frac{31}{72}$. **31.** 5.83\frac{1}{3}$. **32.** 1.40\frac{5}{8}$. **33.** 138\frac{13}{20}$. **34.** $1218\frac{3}{4}$ lb. **35.** $257\frac{13}{27}$ mi. **36.** $549\frac{13}{40}$ ft. **37.** $40\frac{1}{4}$ lb. **38.** 205\frac{5}{8}$. **39.** $84\frac{14}{15}$ mi. **40.** 867\frac{3}{80}$.

Page 62.—**1.** $\frac{5}{9}$. **2.** $\frac{2}{3}$. **3.** 2. **4.** $\frac{1}{24}$. **5.** $\frac{27}{160}$. **6.** $\frac{3}{8}$. **7.** $\frac{16}{195}$. **8.** $\frac{5}{14}$. **9.** $8\frac{1}{3}$. **10.** $\frac{1}{5}$. **11.** $\frac{21}{248}$. **12.** $\frac{1}{4}$. **13.** $\frac{3}{1120}$. **14.** $1\frac{50}{91}$. **15.** $278\frac{4}{7}$. **16.** $\frac{567}{1216}$. **17.** $\frac{5}{18}$. **18.** $\frac{5}{128}$. **19.** $\frac{2}{9}$. **20.** $\frac{54}{259}$. **21.** $\frac{4}{945}$. **22.** $\frac{765}{2548}$. **23.** $\frac{189}{250}$. **24.** $\frac{2}{15}$. **25.** $\frac{4}{5}$.

26. 3. **27.** $2\frac{143}{212}$. **28.** 30. **29.** $23\frac{7}{15}$. **30.** $4\frac{1}{2}$. **31.** $\frac{2}{3}$. **32.** $21\frac{3}{5}$. **33.** $2\frac{1}{4}$. **34.** $\frac{1}{24}$. **35.** $1\frac{7}{13}$. **36.** $17\frac{61}{192}$. **37.** $169\frac{5}{7}$. **38.** $133\frac{1}{3}$. **39.** $\frac{4}{11}$. **40.** $30\frac{3}{8}$.

Page 63.—**1.** 22 bu. 1 pk. 5 qt. **2.** 1966 rd. 1 yd. 6 in. **3.** 35 gal. 3 qt. **4.** 36 T. 4 cwt. 3 lb. 2 oz. **5.** 20 cd. 100 cu. ft. 200 cu. in. **6.** 19 wk. 4 da. 20 hr. 6 min. 40 sec. **7.** 3 A. 20 sq. rd. 1 sq. yd. 1 sq. ft. 72 sq. in. **8.** 86 mi. 200 rd. 3 yd. 3 in. **9.** 27 hhd. 54 gal. 2 qt. 2 gi. **10.** 411 bu. 3 pk. 4 qt. **11.** 17 T. 4 cwt. 40 lb. **12.** 1178 mi. 203 rd. 3 yd. 1 ft. 6 in. **13.** 12 A. 148 sq. rd. 5 sq. yd. 6 sq. ft. 120 sq. in. **14** 4313 gal. 3 qt. **15.** 631 mi. 282 rd. 4 yd. **16.** 187 cd. 4 cu. ft. **17.** 1 mi. 220 ft. **18.** 781 T. 8 cwt. 50 lb. **19.** 1636 bu. 2 pk. 2 qt. **20.** 412 mi. 179 rd. 2 ft. 9 in.

Page 67.—**1.** 3255. **2.** 2073. **3.** 12201. **4.** 93 pk. **5.** 4882. **6.** 746. **7.** 873. **8.** 1836. **9.** 976. **10.** 104. **11.** 1706. **12.** 7. **13.** 7894. **14.** 564. **15.** 9678. **16.** 98 bu. **17.** 9768 A. **18.** $475. **19.** $588\frac{4}{17}$ bu. **20.** 3439 bbl., 134 lb. left. **21.** 265 times, 2540 gal. left. **22.** 27 regiments, 574 men left. **23.** 1825 bales, 473 lb. left. **24.** $75087\frac{12}{13}$ gal. **25.** $5626\frac{24}{63}$ A.

Page 69.—**1.** 6.71. **2.** 62.4. **3.** .00943. **4.** 6,440,000 **5.** 54. **6.** 8000. **7.** 7830. **8.** 2840. **9.** 87.5. **10.** .00324. **11.** 2400. **12.** 2740. **13.** 2.03. **14.** .000075. **15.** $.0233\frac{1}{3}$. **16.** 3.1299+. **17.** .006908+. **18.** 2.3354+. **19.** .0000004+. **20.** 2735.4061+. **21.** 17.165 hr. **22.** 48 da. **23.** 51.875 mi. **24.** 66.4 bu. **25.** 15.62+ mi. **26.** 56.25 rd. **27.** 36.25 cars. **28.** 10.8 da. **29.** 36.1 revolutions. **30.** 17.17+ rd.

Page 72.—**1.** 177 times. **2.** 3203 times. **3.** $2.165. **4.** $\$43.707\frac{1}{7}$. **5.** $487\frac{2}{3}$ bu. **6.** 327 lb. **7.** 50 A. **8.** 362.5 gal. **9.** 417 T. **10.** 120 men. **11.** 1.415 M. **12.** $22\frac{1}{2}$ doz. **13.** $87.25. **14.** $309.9507\frac{59}{63}$ bbl. **15.** 3650 yd. **16.** 356.1111+ qt. **17.** 27500 mi. **18.** 36.605 T. **19.** 87 suits and $15.75 left. **20.** 360 ties.

Page 74.—**1.** 16. **2.** 18. **3.** $13\frac{1}{3}$. **4.** $38\frac{1}{2}$. **5.** $16\frac{4}{5}$. **6.** $21\frac{9}{11}$. **7.** $18\frac{2}{7}$. **8.** $24\frac{4}{9}$. **9.** 49. **10.** $77\frac{1}{3}$. **11.** 30. **12.** $41\frac{11}{13}$. **13.** $25\frac{5}{7}$. **14.** $32\frac{8}{11}$. **15.** $52\frac{12}{13}$. **16.** $22\frac{2}{7}$. **17.** $145\frac{1}{5}$. **18.** $17\frac{1}{15}$. **19.** $16\frac{2}{13}$. **20.** $7\frac{1}{12}$. **21.** $28\frac{2}{7}$. **22.** 75. **23.** 36. **24.** $55\frac{1}{4}$. **25.** $57\frac{3}{5}$. **26.** 35. **27.** $58\frac{2}{3}$. **28.** $68\frac{7}{13}$. **29.** 46. **30.** 68. **31.** $22\frac{1}{2}$ yd. **32.** $33\frac{1}{3}$ steps. **33.** $36\frac{2}{3}$ doz. **34.** 220 pkg. **35.** 432 letters. **36.** $55\frac{1}{4}$ mi. **37.** 24 baskets. **38.** 27 lots. **39.** 45 garments. **40.** 132 lb.

Page 75.—**1.** $4\frac{6}{7}$. **2.** $3\frac{3}{31}$. **3.** $21\frac{21}{25}$. **4.** $5\frac{1}{7}$. **5.** $32\frac{2}{11}$. **6.** $11\frac{13}{17}$. **7.** 21. **8.** $8\frac{8}{35}$. **9.** $1\frac{1}{24}$. **10.** $2\frac{41}{74}$. **11.** 5. **12.** $39\frac{12}{17}$. **13.** $10\frac{18}{35}$. **14.** 7. **15.** $6\frac{34}{101}$. **16.** $14\frac{82}{129}$. **17.** $29\frac{11}{17}$. **18.** $9\frac{37}{51}$. **19.** $38\frac{9}{17}$. **20.** $17\frac{5}{11}$. **21.** 3. **22.** $12\frac{4}{93}$. **23.** $6\frac{14}{95}$. **24.** $3\frac{40}{101}$. **25.** 6. **26.** $5\frac{73}{211}$. **27.** $9\frac{1}{63}$. **28.** $4\frac{579}{670}$. **29.** $4\frac{313}{349}$. **30.** $9\frac{251}{505}$. **31.** $11\frac{1}{3}$ cd. ft **32.** 12 pairs. **33.** $10\frac{58}{59}$ T. **34.** $6\frac{3}{5}$ hr. **35.** 35 cases. **36.** $6\frac{82}{85}$ hr. **37.** *32 bbl.* **38.** $\$5\frac{13}{55}$. **39.** $2043\frac{27}{31}$ steps. **40.** 20 children.

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Page 77 (First Exercise)—1. $\frac{2}{21}$. 2. $\frac{5}{24}$. 3. $\frac{1}{33}$. 4. $\frac{10}{169}$. 5. $\frac{1}{9}$. 6. $\frac{6}{35}$. 7. $\frac{1}{81}$. 8. $\frac{5}{57}$. 9. $\frac{2}{25}$. 10. $\frac{13}{136}$. 11. $\frac{8}{49}$. 12. $\frac{11}{144}$. 13. $\frac{2}{35}$. 14. $\frac{7}{345}$. 15. $\frac{1}{44}$. 16. $\frac{2}{123}$. 17. $\frac{2}{93}$. 18. $\frac{3}{80}$. 19. $\frac{4}{205}$. 20. $\frac{1}{31}$. 21. $\frac{3}{53}$. 22. $\frac{1}{26}$. 23. $\frac{1}{344}$. 24. $\frac{93}{6200}$. 25. $\frac{5}{216}$. 26. $\frac{5}{264}$. 27. $\frac{3}{98}$. 28. $\frac{2}{81}$. 29. $\frac{1}{100}$. 30. $\frac{1}{57}$. 31. $\$\frac{2}{25}$. 32. $\frac{2}{9}$ yd. 33. $\frac{1}{128}$ lb. 34. $\frac{2}{65}$ lb. 35. $2\frac{1}{2}$ ft.

Page 77 (Second Exercise)—1. $\frac{18}{35}$. 2. $1\frac{5}{6}$. 3. $\frac{39}{40}$. 4. $\frac{4}{7}$. 5. $1\frac{11}{18}$. 6. $\frac{27}{32}$. 7. $2\frac{3}{4}$. 8. $2\frac{65}{108}$. 9. $1\frac{15}{34}$. 10. $1\frac{29}{78}$. 11. $1\frac{64}{105}$. 12. $6\frac{55}{84}$. 13. $2\frac{6}{7}$. 14. $3\frac{1}{40}$. 15. $2\frac{58}{135}$. 16. $7\frac{35}{66}$. 17. $2\frac{38}{161}$. 18. $2\frac{22}{25}$. 19. $3\frac{39}{40}$. 20. $2\frac{23}{63}$. 21. $2\frac{7}{44}$. 22. $8\frac{17}{27}$. 23. $4\frac{71}{225}$. 24. $6\frac{244}{363}$. 25. $4\frac{1}{117}$. 26. $6\frac{33}{64}$. 27. $8\frac{91}{480}$. 28. $1\frac{599}{648}$. 29. $8\frac{7}{32}$. 30. $21\frac{227}{294}$. 31. $\$2\frac{37}{56}$. 32. $2\frac{55}{192}$ in. 33. $\$2\frac{93}{170}$. 34. $6\frac{22}{25}$ hr. 35. $\$6\frac{75}{128}$. 36. $13\frac{13}{24}$ bu. 37. $\$8\frac{76}{135}$. 38. $\frac{73}{96}$ lb. 39. $6\frac{45}{64}$ hr. 40. $3\frac{29}{90}$ oz.

Page 79 (First Exercise)—1. $1\frac{1}{4}$. 2. $\frac{32}{35}$. 3. $\frac{32}{55}$. 4. $\frac{40}{117}$. 5. $3\frac{5}{9}$. 6. $2\frac{2}{5}$. 7. $1\frac{1}{21}$. 8. $1\frac{1}{24}$. 9. $1\frac{1}{6}$. 10. $1\frac{5}{91}$. 11. $4\frac{7}{12}$. 12. $\frac{21}{26}$. 13. $\frac{8}{21}$. 14. $\frac{56}{125}$. 15. 4. 16. 8. 17. $\frac{3}{5}$. 18. $1\frac{1}{3}$. 19. $\frac{1}{2}$. 20. 1. 21. $1\frac{386}{1495}$. 22. $10\frac{17}{190}$. 23. $\frac{351}{1634}$. 24. $4\frac{209}{427}$. 25. $1\frac{3149}{5614}$. 26. $2\frac{326}{999}$. 27. $199\frac{61}{104}$. 28. $\frac{320}{567}$. 29. $2\frac{20}{47}$. 30. $\frac{1}{12}$. 31. \$1. 32. $4\frac{2}{3}$ yd. 33. $\$\frac{3}{20}$. 34. $1\frac{1}{8}$. 35. $2\frac{1}{2}$ thirds.

Page 79 (Second Exercise)—1. $\frac{31}{34}$. 2. $1\frac{27}{49}$. 3. $1\frac{12}{17}$. 4. $2\frac{71}{108}$. 5. $1\frac{13}{14}$. 6. $1\frac{13}{54}$. 7. $1\frac{13}{20}$. 8. $2\frac{2}{63}$. 9. $4\frac{11}{19}$. 10. $5\frac{29}{41}$. 11. $2\frac{23}{55}$. 12. $2\frac{193}{340}$. 13. $1\frac{437}{603}$. 14. $3\frac{369}{427}$. 15. $2\frac{1061}{1270}$. 16. $3\frac{71}{148}$. 17. $7\frac{87}{160}$. 18. $2\frac{917}{1164}$. 19. $2\frac{721}{1336}$. 20. $2\frac{1678}{2097}$. 21. $2\frac{92}{137}$. 22. $2\frac{53}{1268}$. 23. $1\frac{149}{150}$. 24. $2\frac{143}{148}$. 25. 2. 26. $2\frac{102}{749}$. 27. $2\frac{407}{744}$. 28. $1\frac{625}{1177}$. 29. $2\frac{3262}{9727}$. 30. 4. 31. 7 yd. 32. 3 doz. 33. 37 steps. 34. $\$3.323\frac{1}{13}$. 35. 47 pkg. 36. $31\frac{61}{204}$ mi. 37. $5\frac{385}{1264}$ mi. 38. $4\frac{32}{49}$ da. 39. 14 times. 40. $5\frac{43}{805}$.

Page 81.—1. $\frac{11}{14}$. 2. $2\frac{5}{24}$. 3. $\frac{3}{16}$. 4. $\frac{4}{5}$. 5. $\frac{5}{8}$. 6. $1\frac{1}{9}$. 7. $1\frac{7}{20}$. 8. $3\frac{1}{3}$. 9. 3. 10. $1\frac{1}{4}$. 11. $\frac{11}{15}$. 12. $\frac{56}{99}$. 13. $1\frac{4}{5}$. 14. 2. 15. 2. 16. 2. 17. $32\frac{4}{15}$. 18. $4\frac{3}{8}$. 19. $\frac{4}{5}$. 20. $3\frac{1}{3}$. 21. $\frac{15}{124}$. 22. $13\frac{1}{8}$. 23. $\frac{7}{8}$. 24. $\frac{1}{8}$. 25. 4. 26. $1\frac{305}{1208}$. 27. $\frac{187}{1450}$. 28. $7\frac{61}{72}$. 29. $3\frac{2}{19}$. 30. $2\frac{31}{1024}$. 31. $4\frac{20}{33}$ rd. 32. $11\frac{19}{26}$ times. 33. 9 boys and $\$2\frac{1}{4}$ left. 34. $1\frac{389}{429}$. 35. $66\frac{1}{2}$. 36. $15\frac{99}{160}$ hr. 37. $\frac{9}{26}$ hr. 38. $4\frac{1}{2}$ times. 39. $\frac{2}{3}$ times. 40. $40\frac{16}{21}$ yd.

Page 83.—1. $\frac{33}{65}$. 2. $\frac{2}{5}$. 3. $\frac{15}{19}$. 4. $\frac{1}{3}$. 5. $\frac{1}{12}$. 6. $\frac{17}{21}$. 7. $\frac{5}{6}$. 8. $1\frac{1}{4}$. 9. $\frac{17}{21}$. 10. $1\frac{3}{7}$.

Page 84 (First Exercise)—1. 900. 2. $49\frac{3}{5}$. 3. $166\frac{6}{7}$. 4. $65\frac{5}{11}$. 5. $178\frac{4}{9}$. 6. 364. 7. $95\frac{5}{14}$. 8. $136\frac{8}{11}$. 9. $247\frac{14}{27}$. 10. $261\frac{6}{7}$

Page 84 (Second Exercise)—1. .375. 2. .313. 3. .444. 4. .778. 5. .727. 6. .933. 7. .867. 8. .889. 9. .583. 10. .762. 11. .824. 12. .917. 13. .438. 14. .357. 15. .923. 16. .353. 17. .737. 18. .320. 19. .789. 20. .643. 21. .625. 22. .733. 23. .649. 24. .167 25. .783. 26. .455. 27. .571. 28. .462. 29. .992. 30. .956. 31. .625 bu. 32. \$.261. 33. .947°. 34. .158 yd. 35. .533 mi.

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Page 85.—**1.** $\frac{11}{50}$. **2.** $\frac{29}{50}$. **3.** $\frac{21}{50}$. **4.** $\frac{37}{50}$. **5.** $\frac{13}{40}$. **6.** $\frac{5}{8}$. **7.** $\frac{169}{200}$. **8.** $\frac{9}{40}$. **9.** $\frac{3}{8}$. **10.** $\frac{33}{40}$. **11.** $\frac{1}{8}$. **12.** $\frac{11}{40}$. **13.** $\frac{49}{80}$. **14.** $\frac{39}{80}$. **15.** $\frac{2413}{5000}$. **16.** $\frac{527}{5000}$. **17.** $\frac{33}{400}$. **18.** $\frac{3}{80}$. **19.** $\frac{1}{400}$. **20.** $\frac{13}{16}$. **21.** $\frac{313}{400}$. **22.** $\frac{7}{80}$. **23.** $\frac{7}{32}$. **24.** $\frac{257}{800}$. **25.** $\frac{113}{250}$. **26.** $\frac{11}{16}$. **27.** $\frac{48}{625}$. **28.** $\frac{108}{625}$. **29.** $\frac{1}{11}$. **30.** $\frac{1}{9}$. **31.** $\frac{3}{7}$. **32.** $\frac{5}{9}$. **33.** $\frac{11}{12}$. **34.** $\frac{7}{8}$. **35.** $\frac{5}{15}$.

Page 87.—**1.** 36 sq. yd. 2 sq. ft. 73 sq. in. **2.** 2 da. 8 hr. 58 min. **3.** 84 sq. rd. 6 sq. ft. $10\frac{1}{10}$ sq. in. **4.** 1 cd. 3 cd. ft. $9\frac{31}{35}$ cu. ft. **5.** 1 wk. 3 da. 11 hr. 15 min. 2 sec. **6.** 24yd. 2 ft. $3\frac{14}{15}$ in. **7.** 32 mi. 295 rd. 2 ft. 2 in. **8.** 1 wk. 3 da. 12 hr. $17\frac{17}{24}$ min. **9.** 1 cu. yd. 2 cu. ft. $807\frac{1}{5}$ cu. in. **10.** 123 bu. $3\frac{7}{8}$ qt. **11.** 496 bags, 23 qt. left. **12.** 1 T. 3 cwt. $78\frac{1}{3}$ lb. **13.** 6. **14.** 5 men. **15.** 1 bu. 2 pk. 2 qt. $1\frac{1}{5}$ pt. **16.** 131 strings and 3 yd. 7 in. left. **17.** 60 boxes, and 5 pk. 1 qt. 1 pt. left. **18.** 48 rd. 1 yd. 2 ft. $11\frac{1}{2}$ in. **19.** $56\frac{152}{283}$ bars. **20.** 29 A. 153 sq. rd. 30 sq. yd. 1 sq. ft. $93\frac{3}{5}$ sq. in.

Page 90.—**1.** 113.0976 ft. **2.** 43.9824 in. **3.** 25.1328 yd. **4.** 20.4204 ft. **5.** 386.4168 ft. **6.** 226.1952 ft. **7.** 113.0976 in. **8.** 18.8496 yd. **9.** 21.9912 ft. **10.** 251.328 ft. **11.** 200 ft. **12.** 600 ft. **13.** 268.97 + ft. **14.** 2.54 + yd. **15.** 5.72 + ft. **16.** 16 ft. **17.** 28 yd. **18.** 32 in. **19.** $6\frac{1}{2}$ ft. **20.** $4\frac{2}{3}$ ft. **21.** 6 ft. **22.** 3 in. **23.** $2\frac{1}{4}$ ft. **24.** $1\frac{1}{2}$ in. **25.** radius. **26.** 9.54 + ft. **27.** 13.60 + ft. **28.** 2.90 + ft. **29.** 22.28 + ft. **30.** .01 mi.

Page 93.—**1.** $6\frac{1}{4}$ sq. ft. **2.** $38\frac{35}{36}$ sq. yd. **3.** $34\frac{19}{32}$ sq. rd. **4.** $73\frac{97}{144}$ sq. yd. **5.** 52 sq. yd. **6.** $1\frac{1}{16}$ ft. **7.** 96800 sq. yd. **8.** $85\frac{9}{16}$ sq. ft. **9.** $4923\frac{3}{16}$ sq. ft. **10.** 352 sq. ft. **11.** $7812\frac{1}{2}$ sq. ft. **12.** $13\frac{13}{16}$ sq. in. **13.** $22\frac{1}{2}$ sq. yd. **14.** 15 sq. ft. **15.** 49776 sq. rd.

Page 94.—**1.** 4375 sq. ft. **2.** 19592 sq. ft. **3.** $43\frac{1}{32}$ sq. ft. **4.** 192 sq. ft. **5.** 37120 sq. ft. **6.** rectangular, 450 sq. ft. **7.** 420 sq. ft. **8.** $5280. **9.** $327\frac{1}{9}$ sq. yd. **10.** $1\frac{137}{288}$. sq ft.

Page 96.—**1.** 3400 sq. ft. **2.** 49 sq. rd. **3.** 204 sq. in. **4.** 165000 sq. yd. **5.** 328 sq. in. **6.** 8 sq. ft. **7.** $4\frac{1}{2}$ sq. ft. **8.** 10 sq. ft. **9.** 6 sq. ft. **10.** $4\frac{2}{3}$ sq. ft.

Page 97.—**1.** 28.2744 sq. ft. **2.** 7854 sq. ft. **3.** 122.71875 sq. ft. **4.** 314.16 sq. in. **5.** 5026.56 sq. ft. **6.** 6361.74 sq. rd. **7.** .7854 sq. rd. **8.** .6013 sq. in. **9.** 14.9226 sq. ft. **10.** 11.0447 sq. ft.

Page 98.—**1.** 392 sq. ft. **2.** 27 sq. ft. **3.** 448 sq. ft. **4.** 10 sq. ft. **5.** $83\frac{5}{9}$ sq. yd. **6.** $18\frac{8}{9}$ sq. yd. **7.** 336 sq. ft. **8.** $0.60. **9.** $11\frac{3}{4}$ sq. ft. **10.** 1152 sq. ft.

Page 100.—**1.** 282.744 sq. in. **2.** 301.5936 sq. in. **3.** 138.2304 sq. in. **4.** 579.6252 sq. in. **5.** 406.8372 sq. in. **6.** 596 904 sq. in. **7.** 322.014 sq. in. **8.** 692.7228 sq. in. **9.** 980.1792 sq. in. **10.** 2671.9308 sq. in. **11.** 471 ft. 2.88 in. **12.** 1055.5776 sq. in. **13.** 351.8592 sq. in. **14.** 1899.0972 sq. ft. **15.** 150.7968 sq. in.

Page 101.—**1.** 49 yd. **2.** 25 yd. **3.** $66\frac{2}{3}$ yd. **4.** 18 yd **5.** 30 yd. **6.** $51\frac{1}{3}$ yd. **7.** 36 yd. **8.** 20 yd. **9.** $46\frac{2}{3}$ yd

10. $37\frac{1}{3}$ yd. **11.** $16\frac{2}{3}$ yd. **12.** Widthwise. **13.** Widthwise. **14.** Same. **15.** $52\frac{1}{9}$ yd.

Page 104.—**1.** 4 double rolls, 1 single roll. **2.** 5 double rolls, 1 single roll. **3.** 7 double rolls. **4.** 6 double rolls, 1 single roll. **5.** 7 double rolls. **6.** 8 double rolls, 1 single roll. **7.** 8 double rolls, 1 single roll. **8.** 8 double rolls. **9.** 10 double rolls. **10.** 5 double rolls, 20 yd. of border.

Page 106.—**1.** 1000 cu. ft. **2.** 348 cu. ft. **3.** $72\frac{33}{64}$ cu. in. **4.** 387 cu. ft. **5.** 57.8 + bu. **6.** $325\frac{9}{11}$ gal. **7.** 192 cu. ft. **8.** 192 cu. in. **9.** 2240 cubes. **10.** 9216 cu. ft. **11.** 540 cu. ft. **12.** 1134 cu. ft. **13.** $80\frac{16}{27}$ cu. yd. **14.** $495\frac{1}{9}$ sq. yd. **15.** $509\frac{1}{3}$ sq. yd.

Page 108.—**1.** 28.2744 cu. in. **2.** 9.4248 cu. ft. **3.** 66.096 gal. **4.** 185.0688 gal. **5.** 65.35 + times. **6.** 5.7942 cu. ft. **7.** .1636 + cu. ft. **8.** 153.6 pails. **9.** 3392.928 cu. in. **10.** 5 inch box.

Page 109.—**1.** 64 bd. ft. **2.** 90 bd. ft. **3.** 540 bd. ft. **4.** $106\frac{2}{3}$ bd. ft. **5.** 1264 bd. ft. **6.** 27 ft. in length. **7.** 2880 bd. ft. **8.** 8 boards. **9.** $145.20. **10.** $37.80.

Page 110.—**1.** $39.38. **2.** 16 cd. **3.** $2\frac{2}{3}$ ft. **4.** 15 cd. **5.** $67.50.

Page 111.—**1.** 270 bu. **2.** 120.53 + bu. **3.** 117.23 + bu. **4.** $254\frac{52}{77}$ gal. **5.** 2511 gal. **6.** 2127.82 + lb. **7.** 20979.49 + lb. **8.** $7\frac{61}{77}$ gal. **9.** $65\frac{5}{48}$ lb. **10.** 127,968.75 lb.

Page 115.—**1.** 85.8. **2.** 28.81. **3.** 73.525. **4.** 162.75. **5.** 289. **6.** $1317.33\frac{1}{3}$. **7.** 103.88. **8.** 39.99. **9.** 851.2. **10.** 25.9. **11.** 1111.95. **12.** 833. **13.** 120.46. **14.** 198. **15.** 1636. **16.** 676.45. **17.** 5.46. **18.** 5.49. **19.** 171.52. **20.** 22.54. **21.** 86.31 A. **22.** 102 pupils. **23.** 187.2 bu. **24.** $14192.10. **25.** $800. **26.** $1545.12. **27.** 641.7 T: **28.** 66.59. **29.** No. 2 is $54.12 better. **30.** 784 men.

Page 116.—**1.** 64%. **2.** 12%. **3.** 20%. **4.** $37\frac{1}{2}$%. **5.** 70%. **6.** 15%. **7.** $3\frac{1}{3}$%. **8.** 5%. **9.** $27\frac{13}{31}$%. **10.** 14000%. **11.** $91\frac{13}{17}$%. **12.** $3\frac{29}{32}$%. **13.** 25%. **14.** $47\frac{1}{2}$%. **15.** $11\frac{43}{72}$%. **16.** $93\frac{1}{3}$%. **17.** $25\frac{25}{27}$%. **18.** $44\frac{1}{21}$%. **19.** 48%. **20.** $14\frac{2}{7}$%.

Page 119.—**1.** $9362. **2.** 1200 men. **3.** $14080. **4.** 930 pupils. **5.** $103.50. **6.** 526. **7.** $816. **8.** $200. **9.** 714. **10.** 36.

Page 122.—**1.** $96. **2.** $150. **3.** $100. **4.** $69. **5.** $36.80. **6.** $287. **7.** 159.25. **8.** $$81.81\frac{9}{11}$. **9.** $126. **10.** $368. **11.** $11,100. **12.** $32,100. **13.** $12,300: **14.** $16. **15.** $30. **16.** $25. **17.** $9. **18.** $3.20. **19.** $41. **20.** $15.75. **21.** $$8\frac{2}{11}$. **22.** $21. **23.** $23. **24.** $1665. **25.** $3852. **26.** $1968. **27.** $3360. **28.** $54. **29.** $65.625. **30.** $$3.69\frac{3}{13}$. **31.** $12\frac{1}{2}$%. **32.** $6\frac{1}{4}$%. **33.** 28%. **34.** 12%. **35.** 20%. **36.** $21\frac{3}{7}$%. **37.** $$666\frac{2}{3}$. **38.** $20. **39.** $33.75. ***40.*** $0.30. **41.** $4\frac{1}{6}$%.

Page 126.—**1.** $8.04. **2.** $7500. **3.** $40. **4.** $5376. ***5.*** ***$12.95.*** ***6.*** $200.85. **7.** $142.50. **8.** $5625. **9.** $18400.

10. $1270. 11. 1300 bbl. 12. 2¼%. 13. $4.80. 14. $19000. 15. $576.

Page 129.—1. $36. 2. $198. 3. $287. 4. $75. 5. $16.88. 6. $309.26. 7. $3696.84. 8. $60.90. 9. $132.36. 10. $856. 11. $25.14. 12. $128.25. 13. $209.85. 14. $40.38. 15. $70.85. 16. $858.12. 17. $87.69. 18. $72.21. 19. $221.14. 20. $20.31. 21. $19.88. 22. $3.10. 23. $25.60. 24. $253.62. 25. $512.44.

Page 131.—1. $25. 2. $95.62½. 3. 2½%. 4. $4960.80. 5. $2500. 6. $2092.20. 7. $16000. 8. $6385.71³⁄₇. 9. 1⅓%. 10. $27,775.20.

Page 133.—1. $750. 2. $592. 3. $135. 4. $70. 5. $11.25. 6. $825. 7. $236.25. 8. $133.20. 9. $8.64. 10. $585. 11. $134.80. 12. $411.09. 13. $157.21. 14. $1059.75. 15. $1125.

Page 134.—1. $103.60. 2. $46.46. 3. $513.50. 4. $157.93. 5. $53.44. 6. $118.92. 7. $38.12. 8. $4240. 9. $4500. 10. $7600. 11. $2800. 12. $5100. 13. $12.50. 14. $14.20. 15. $17.10.

Page 136.—1. $4928.13. 2. $2202. 3. $18,250.50. 4. $1581. 5. $7344. 6. 270 shares. 7. Mexican Central .02% better. 8. $28,590¾. 9. 426 shares. 10. $3934. 11. $6688. 12. $99,975¾. 13. $76. 14. $984. 15. Same.

Page 138.—1. 18 yr. 3 mo. 9 da. 2. 3 yr. 1 mo. 16 da. 3. 15 yr. 2 mo. 15 da. 4. 8 yr. 7 mo. 1 da. 5. 14 yr. 8 mo. 7 da. 6. 116 yr. 9 mo. 2 da. 7. 155 yr. 6 mo. 14 da. 8. 67 yr. 9 mo. 22 da. 9. 11 yr. 6 mo. 25 da. 10. 3 mo. 23 da.

Page 139.—1. $80. 2. $56. 3. $98. 4. $76.50. 5. $59.10. 6. $171.25. 7. $36.88. 8. $76.30. 9. $97.80. 10. $21.76.

Page 140.—1. $6.00 2. $4.35. 3. $8.97. 4. $0.14. 5. $0.56. 6. $2.62. 7. $3.42. 8. $1.96. 9. $35. 10. $32.68.

Page 141.—1. $0.63. 2. $0.43. 3. $0.30. 4. $0.70. 5. $0.83. 6. $1.70. 7. $0.32. 8. $0.06. 9. $0.35. 10. $0.07.

Page 142.—1. $32. 2. $89.32. 3. $244.42. 4. $18.77. 5. $711.51. 6. $134.97. 7. $49.36. 8. $142.61. 9. $257.69. 10. $1632.40. 11. $38.88. 12. $28.23. 13. $14.92. 14. $1033.70. 15. $102.58. 16. $17.32. 17. $633.87. 18. $60.54. 19. $657.13. 20. $82.56. 21. $602.08. 22. $1212.35. 23. $545.15. 24. $1322.40. 25. $10770.53. 26. $121.87. 27. $175.96. 28. $55.40. 29. $33.31. 30. $150.10.

Page 144.—1. 6%. 2. 6%. 3. 4½%. 4. 6%. 5. 5%. 6. 2 yr. 9 mo. 7. 2 yr. 1 mo. 6 da. 8. 1 yr. 3 mo. 18 da. 9. 2 yr. 1 mo. 24 da. 10. 1 yr. 2 mo. 12 da. 11. $62.50. 12. $180. 13. $4440. 14. $7580. 15. $15520. 16. $540. 17. $475. 18. $450. 19. $668.99. 20. $1180.